
Missouri Registry Annual Report

Registry of Confirmed Abandoned or Uncontrolled
Hazardous Waste Disposal Sites in Missouri

Fiscal Year 2022



**Missouri Department of Natural Resources
Division of Environmental Quality
Environmental Remediation Program**

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Missouri Department of Natural Resources

Missouri Registry Annual Report

INTRODUCTION

As required by Section 260.445, RSMo, the Missouri Department of Natural Resources (Department) prepares an annual report regarding sites listed on the Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites in Missouri. The Department provides a copy of the registry report to the General Assembly, Governor, Missouri Hazardous Waste Management Commission, and the governing body of each county containing a registry site. The report also is available on the Department's website.

The Missouri Hazardous Waste Management Law regarding the Registry (Sections 260.435 to 260.480, RSMo) can be viewed at <https://revisor.mo.gov/main/OneChapter.aspx?chapter=260>

REGISTRY AND REGISTRY PROCEDURES

REGISTRY OF CONFIRMED ABANDONED OR UNCONTROLLED HAZARDOUS WASTE DISPOSAL SITES IN MISSOURI (REGISTRY)

The registry is a list of sites in Missouri that contain abandoned or uncontrolled hazardous waste. More than that, the registry provides a variety of institutional controls allowing residual contamination to be left on site after cleanup is completed, while still protecting human health and the environment. These institutional controls include: deed notification of contamination; annual inspection; notice to buyer; change of use review; notice to the state if property is sold; cleanup and removal from the registry; and public information about site location, classification of threat, contaminants, health concerns, public and private drinking-water wells, and geology.

In addition, information in the registry notifies the public about properties listed on the registry and their associated hazards. This report informs potential buyers about hazards and legal obligations they may undertake if they purchase a property listed on the registry.

The registry is not intended or legally required to provide a comprehensive inventory of sites where hazardous chemicals and wastes have been disposed of in Missouri. Instead, it is developed based on a specific legal mandate, which directs that sites be listed on the registry if they are contaminated with hazardous substances that:

- A. Meet the legal definition of hazardous waste according to Missouri statutes and regulations. In practice, this means definitions the state has incorporated by reference from federal statute, the Resource Conservation and Recovery Act of 1976 (RCRA), and would be subject to RCRA regulations. A waste is considered hazardous under RCRA if it meets either of the following criteria:
 - a. It is specifically listed or identified as a hazardous waste in the Code of Federal Regulations due to its composition and source, or
 - b. It exhibits one or more characteristics of a hazardous waste, which are ignitability,

- corrosivity, reactivity, or toxicity as determined by laboratory analysis;
- B. Were disposed of before state and federal regulations were established for that kind of waste, which began in 1980, or disposed of illegally since that time; and
- C. Are present at concentrations above health-based screening levels.

Each site on the registry is described in detail in this annual report and includes the following information:

- A. A general description of the site, including the name and address, owner, and the type and quantity of hazardous waste disposed of there.
- B. A summary of any significant environmental problems at and near the site, and the site's proximity to private residences, public buildings or property, school facilities, places of work, or other areas where individuals may be present regularly.
- C. A summary of any serious health problems in the immediate vicinity of the site and any health problems deemed by the Department to be related to conditions at the site.
- D. The status of any testing, monitoring, or remedial actions in progress or recommended by the Department; the status of any pending legal actions and any federal, state, or local government permits; and the relative priority for remedial action at each site.

The Department evaluates the sites on the registry and assesses classification changes. The Department can take into account new information about a site or remedial measures taken to reduce potential risk. If conditions at a site have changed over the past fiscal year, the Department may change a site's classification to better define the threat to human health and the environment posed by a site.

Registry sites are placed in one of the following categories:

- Class 1: Sites presenting an imminent danger of causing irreversible or irreparable damage to public health or environment—immediate action required.
- Class 2: Sites posing a significant threat to the environment—action required.
- Class 3: Sites not presenting a significant threat to public health or the environment—action may be deferred.
- Class 4: Sites that have been properly closed—require continued management.
- Class 5: Sites that have been properly closed with no evidence of present or potential adverse impact—no further action required. Class 5 sites are removed from the Registry.

The relative need for action at each site is based solely upon the potential impact on public health and the environment. The type of action required, the feasibility of such an action, and its cost or benefits are not the primary factors in deciding whether action is needed.

REGISTRY PROCEDURES

The Department investigates potential abandoned or uncontrolled hazardous waste disposal sites and identifies those that should be placed on the registry. When hazardous waste is confirmed at a site, the Department notifies the owner or owners that it intends to place the property on the registry. The notification is sent by certified mail to the owner's last known address 30 days before the site is to be listed on the registry.

The owner or operator may appeal the proposed addition to the Registry to the Administrative Hearing Commission, which conducts hearings in accordance with Section 621.250, RSMo. No site may be listed on the registry until an appeal is resolved. Once the notice of appeal is filed, the Administrative Hearing Commission has 90 days to hold a hearing and 120 days to issue a recommended decision on the appeal to the Hazardous Waste Management Commission. The Hazardous Waste Management Commission reviews the Administrative Hearing Commission's recommended decision and issues a final decision.

To avoid registry listing, a responsible party or site owner may remediate the site. Generally, the Department will enter into an agreement with the party that ensures cleanup progresses in a timely manner and recognizes the Department's oversight role. With those controls in place, the Department will then suspend further actions to list the property on the registry.

If the owner does not want the entire property placed on the registry, the listing may be limited to the contaminated portion of the property if the owner or operator submits a land survey performed by a licensed surveyor that includes the contaminated area plus a buffer zone in all directions. This allows the owner or operator unrestricted use of the portion of the property that is not contaminated.

When a site is placed on the registry, the Department files a notice of the listing in the property chain of title with the Recorder of Deeds. If a site is properly closed, with no evidence of a potentially adverse impact, this finding also is filed with the Recorder of Deeds. These actions notify any purchasers of the property that the site is or has been on the registry.

Once a site is placed on the registry, it is subject to certain restrictions. The use of the site shall not change substantially without the written approval of the director of the Department. A change of use is considered substantial if it may result in: the spread of contamination, an increase in human exposure to hazardous materials, an increase in adverse environmental impacts, or a situation making potential remedial actions at the site more difficult. The seller must notify the buyer of the condition of the site prior to sale. Changes of ownership must be reported to the Department within 30 days after the change.

On Jan. 1, 2008, the Missouri Environmental Covenants Act (MoECA) became effective. MoECA, Sections 260.1000 to 260.1039, RSMo, creates a uniform standard for environmental covenants and directs the Department to create a public database of properties that have restrictions provided for by this law. Environmental covenants are recorded in a property's chain of title and notify prospective buyers of specific limitations about land use and activities due to the environmental condition of the property. The Department utilizes tools such as environmental covenants to track sites with residual contamination to ensure remaining hazardous materials do not pose an unacceptable exposure risk to public health and the environment. Some registry site owners are pursuing execution of an environmental covenant pursuant to MoECA as the final step in their remedial actions. This would allow sites with residual contamination to be removed from the registry once the covenant is executed and recorded.

Additional information on the Registry and Registry procedures is available on the Department's website <https://dnr.mo.gov/env/hwp/sfund/registry.htm>.

NATIONAL PRIORITIES LIST SITES IN MISSOURI

The National Priorities List is a list of sites being cleaned up pursuant to the Comprehensive, Environmental Response, Compensation, and Liability Act. This list is maintained and updated by the U.S. Environmental Protection Agency. Federal and state officials work together to determine priority sites and submit candidate sites for inclusion on the National Priorities List. The National Priorities List includes the sites with the highest priority for further investigation pursuant to the federal Superfund Program. Candidate sites are ranked on a scale from 0 to 100, using a numerical scoring system known as the Hazard Ranking System. The system evaluates the threat a site poses to human health or the environment through contamination of soil, surface water, groundwater, or air. Hazardous waste sites with a quality-assured Hazard Ranking System score equal to or greater than 28.5 are eligible for inclusion on the National Priorities List. Sites for which the Centers for Disease Control and Prevention has issued a health advisory are also eligible, regardless of the score.

As of June 30, 2022, Missouri has 33 sites on the National Priorities List. Presented below is the list of those 33 Missouri sites and the corresponding site information web link. Of these 33 sites, 10 are listed on the registry. Registry sites are bolded.

NATIONAL PRIORITIES LIST SITES IN MISSOURI

1. **Armour Road** **NPL List Date: May 10, 1999**
2251 Armour Road
North Kansas City, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0702515>
2. Bee Cee Manufacturing Co. **NPL List Date: June 10, 1986**
Malden Industrial Park
Malden, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701439>
3. Big River Mine Tailings/ **NPL List Date: Oct. 14, 1992**
St. Joe Minerals Corp.
Sec. 25, 26, 35 & 46, T. 37N, R. 4E
Desloge, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701639>
4. Compass Plaza **NPL List Date: March 15, 2012**
201 S. Marshall St.
Rogersville, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0706143>
5. **Conservation Chemical Co.** **NPL List Date: Oct. 4, 1989**
8900 Front St.
Kansas City, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0700777>
6. **Ellisville Site** **NPL List Date: Sept. 8, 1983**
149 Strecker Road
Ellisville, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701205>

7. Fulbright Landfill
Bolivar Road
Springfield, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701153>
NPL List Date: Sept. 8, 1983
8. **Lake City Army Ammunition Plant**
(Northwest Lagoon)
Junction Highway 7 and Highway 78
Independence, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701757>
NPL List Date: July 22, 1987
9. **Lee Chemical**
Highway 210 east of Highway 291
Liberty, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701378>
NPL List Date: June 10, 1986
10. Madison County Mines
Fredericktown, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701102>
NPL List Date: Oct. 29, 2003
11. **Minker/Stout/Romaine Creek**
4037 W. Rock Creek Road and Swaller Road
Imperial, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701345>
NPL List Date: Sept. 8, 1983
12. Missouri Electric Works
S. Highway 61, two miles south of Highway K
Cape Girardeau, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701474>
NPL List Date: Feb. 21, 1990
13. Newton County Mine Tailings
Various Locations
Newton County, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701651>
NPL List Date: Oct. 29, 2003
14. Newton County Wells
3900 Rangeline Road
Joplin, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0702514>
NPL List Date: July 27, 2000
15. Oak Grove Village Well
206 James St.
Oak Grove Village, Mo,
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0700020>
NPL List Date: Sept. 5, 2002
16. Oronogo-Duenweg Mining Belt
Various Locations
Oronogo-Duenweg, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701290>
NPL List Date: Aug. 30, 1990
17. Pools Prairie
Highway 60 and U.S. Highway 71
Neosho, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0702918>
NPL List Date: Sept. 17, 1999

18. Quality Plating
Route 2
Sikeston, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701442>
NPL List Date: June 10, 1986
19. Riverfront
New Haven, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0702089>
NPL List Date: Dec. 1, 2000
20. **Solid State Circuits, Inc.**
Main St.
Republic, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701392>
NPL List Date: June 10, 1986
21. Southwest Jefferson County Mining
166 sq. miles in southwest quarter of Jefferson County
De Soto, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705443>
NPL List Date: Sept. 23, 2009
22. Sporlan Valve Plant #1
611 East 7th Street
Washington, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0703541>
NPL List Date: May 15, 2019
23. St. Louis Airport/HISS/Futura Coatings Co.
Brown Road north of Airport
Hazelwood, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701210>
NPL List Date: Oct. 4, 1989
24. **Syntex Facility**
299 Extention St.
Verona, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0700881>
NPL List Date: Sept. 8, 1983
25. Valley Park TCE
Highway 141 north of Meramec River
Valley Park, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701494>
NPL List Date: June 10, 1986
26. Vienna Wells
545-547 N. Chestnut St.
Vienna, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705803>
NPL List Date: Sept. 29, 2010
27. Washington County Lead District-Furnace Creek
Two miles north of intersection of Big River and Highway 21
Caledonia, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705842>
NPL List Date: April 11, 2011
28. Washington County Lead District-Old Mines
Intersection of Highway 21 and Highway 47
Old Mines, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705027>
NPL List Date: March 19, 2008

29. Washington County Lead District-Potosi
500 feet east of Bell St. and Valley Road
Potosi, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705023>
NPL List Date: March 19, 2008
30. Washington Co. Lead District-Richwoods
21 acres in northeast Washington County
Richwoods, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705032>
NPL List Date: March 19, 2008
31. Weldon Spring Former Army Ordnance Works
Highway 94, south of U.S. 40
Weldon Spring, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701773>
NPL List Date: Feb. 21, 1990
32. Weldon Spring Quarry/Plant/Pits
Highway 94, two miles south of U.S. 40
Weldon Spring, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701753>
NPL List Date: July 22, 1987
33. **West Lake Landfill**
13570 St. Charles Rock Road
Bridgeton, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701039>
NPL List Date: Aug. 30, 1990

CLEANUPS

Registry Consent Agreements

Some owners whose property is proposed for the registry would prefer to remediate a site to Class 5, rather than allow it to be placed on the registry. Site owners or potentially responsible parties wishing to clean up a site may negotiate a Registry Consent Agreement with the Department. The consent agreement establishes a schedule and specific responsibilities for the completion of site investigation and remediation by the property owner or responsible party. All activities are completed with the Department's oversight. Upon successful completion of site remediation, the Department withdraws its registry action.

As of June 30, 2022, responsible parties were cleaning up eight sites pursuant to state Registry Consent Agreements. These sites are identified in the following list:

- | | |
|---|---|
| 1. Emerson Electric
8100 W. Florissant
St. Louis, MO 63136 | 5. Orbco (Orscheln)
1177 N. Morley
Moberly, MO 65270 |
| 2. Joplin Pipe & Steel
506 Tyler Ave.
Joplin, MO 64801 | 6. SKF Foundry
1801 W. Main St.
Washington, MO 63090 |
| 3. Litton Systems
4811 W. Kearney St.
Springfield, MO 65803 | 7. Toastmaster Kirksville
1301 N. Osteopathy
Kirksville, MO 63501 |
| 4. Missouri Metals
9970 Page Blvd.
Overland, MO 63132 | 8. TRW Manchester
14161 Manchester Road
Manchester, MO 63011 |

REGISTRY SITES REMOVED OR ACTION SUSPENDED

The following table lists sites that either were removed from the registry, or registry action was suspended.

Site	Address	Date Proposed for Registry	Date Registered	Date Removed from Registry	Date Registry Action Suspended
Abrahamson Property	4044 West Rock Creek Rd, Imperial, MO 63052	2/11/84	6/14/84	9/26/86	NA
Acetylene Gas	3529 Hickory St., St. Louis,	9/25/86	3/10/87	2/12/97	NA
ACF Industries	2800 DeKalb St., St. Louis,	2/9/84	2/22/85	6/11/19	NA
Armco Union Wire Rope Plant	2100 Manchester Trafficway, Kansas City, MO 64126	7/27/89	NA	NA	1/20/93
Arneson Timber	Steelville, MO 65565	2/4/99	7/1/99	8/11/09	NA
AT&T	777 N. Blue Hwy, Lee's Summit, MO 64063	12/27/89	NA	NA	9/3/92
Baxter Garden Center	17259 Wild Horse Creek Road, Chesterfield,	8/26/83	1/1/84	2/18/97	NA
Bee Cee Manufacturing	Falcon Dr., Malden, MO	11/17/87	7/8/88	5/24/19	NA
Bemis Company	1295 North Highway Dr., Fenton, MO 63026	10/20/87	NA	NA	6/17/10
Boulder Valley Campground	Highway AA, four miles southwest of Highway H, Syenite, MO 63640	4/18/85	NA	NA	5/1/85
Branson Quarry	Highway 65, three miles north of Branson, Branson, MO	8/27/83	1/5/84	1/15/91	NA
Bristol Steel	3117 S. Big Bend Blvd., Maplewood, MO 63143	1/19/88	NA	NA	4/14/91
Bubbling Springs Arena	1300 Romaine Creek Rd., Fenton, MO 63026	8/26/83	1/9/84	9/18/89	NA

Bull Moose Tube Company	406 Industrial Dr., Gerald, MO 63037	8/26/83	NA	NA	2/5/98
Burlington Northern Railroad - Cottrell Property	Highway 19 N. of Cherryville, Cherryville, MO 65446	1/25/96	3/25/96	10/6/00	NA
Burlington Northern Railroad - Crider Property	Highway 19 and Becker, Steelville, MO 65565	1/30/96	9/26/96	8/1/04	NA
Burlington Northern Railroad - Richards Property	HC 86 Box 6151, Steelville, MO 65565	1/27/96	NA	NA	8/29/00
Burlington Northern Railroad - Wright Property	Highway 19, half mile south of Cherryville, Cherryville,	2/9/86	4/11/96	10/31/00	NA
Cashel Residence	2306 Romaine Creek Rd., Fenton, MO 63026	8/27/83	NA	NA	10/4/85
Castlewood (Sontag Road Swim Club and Fire Station)	1000 New Ballwin Rd., Ballwin, MO 63021	8/26/83	1/3/84	11/1/87	NA
Community Christian Church	623 Meramec Station Rd., Manchester, MO 63021	8/26/83	NA	NA	2/5/98
Cooksey's Barrel	Route 1, Village Ridge, MO, 63089	8/27/83	6/14/84	4/19/93	NA
Craft World International	603 W. Plainview Rd., Springfield, MO 65807	4/5/88	NA	NA	6/20/89
Defiance Dump Site #1	Near 643 Old Colony Rd., Defiance, MO 63341	8/27/83	NA	NA	4/10/84
Detroit Tool	100 Carr St., Lebanon, MO 65536	3/12/90	NA	NA	12/22/95
Dexter Plating	Arvin Rd., Dexter, MO 63841	8/8/86	NA	NA	9/3/92
Dora Post and Lumber Co	Highway 181, Dora, MO 65637	3/7/03	4/18/03	4/21/08	NA
Dorman's Industry	Highway 254, Galmey, MO 65779	6/18/87	8/17/87	2/1/06	NA
East North Avenue	E. North St., Williams Rd., Eureka, MO 63025	2/9/84	NA	NA	2/5/88

East Texas Motor Freight	119 Douglass St., St. Louis, MO 63147	6/24/96	NA	NA	2/5/98
Eggman Drum	6.4 miles south of intersection of Routes 8 and 21, Potosi, MO 63116	3/7/86	3/16/87	12/28/90	NA
Ellisville-Rosalie Property	Wildwood, MO 63011	8/27/83	9/21/84	9/8/87	NA
Erwin Farm	1.5 miles north of Verona, Verona, MO 65707	8/27/83	1/3/84	10/9/87	NA
Excelsior Springs FMGP	320 W. Excelsior St., Excelsior Springs, MO 64024	3/25/03	5/6/03	5/24/19	NA
Fire Trail 11-H	Steelville, MO 65565	5/17/84	NA	NA	8/1/84
Folk Avenue	7882 Folk Ave., Maplewood, MO 63143	2/9/84	NA	NA	11/15/07
Frontenac (Bliss Tank Farm)	German Blvd. and Dwyer Lots, Frontenac, MO 63131	8/26/83	3/19/90	3/30/98	NA
Fulbright Landfill	Boliver Rd, Springfield, MO 65802	8/29/83	1/1/84	6/30/16	NA
G&R Metals	½ block E Callan & Industrial, Monett, MO 65708	5/14/87	8/17/89	6/10/19	NA
General Electric/Enterprise Park	2401 Sunshine St. Springfield, MO 65804	7/29/85	NA	NA	3/3/88
Generally Hauling	2.5 miles east off Route 47 on Route TT, St. Clair, MO 63084	6/10/87	8/17/87	11/2/99	NA
Great Lakes Container Corp	42 Ferry St., St. Louis, MO 63147	2/5/88	NA	NA	6/27/88
Grimco Signs	1 L and D Dr., Owensville, MO 65066	2/4/88	NA	NA	1/5/90
Hamill Transfer	3225 Chouteau Ave., St. Louis, MO 63103	8/29/83	9/3/85	2/12/87	NA
Hardt Road	18538 Hardt Rd., Glencoe, MO 63021	8/27/83	2/22/85	12/1/87	NA

Removed or Action Suspended

Registry Sites Removed/Action Suspended

Hellwig Fruit Stand	7800 Chesterfield Airport Rd., Chesterfield, MO 63005	6/1/90	NA	NA	5/12/92
Hendren Salvage Yard	705 Proctor Dr., Columbia, MO 65202	1/23/88	NA	NA	7/31/88
International Paper	2609 S. Rangeline, Joplin, MO 64801	2/9/1984	6/14/1984	6/30/2014	NA
Kem-Pest Laboratories	East of State Hwy 177, Cape Girardeau,	3/17/87	NA	NA	10/26/00
King Adhesives	5231 Northrup Ave., St. Louis, MO 63110	5/30/02	6/23/03	1/26/06	NA
Kramer	2101 Old Bismarck Rd., Park Hills, MO 63601	8/11/89	NA	NA	4/10/97
Lacy Manor Development (Sandcut Road)	403 B Sandcut Rd., Catawissa, MO 63016	8/26/83	12/27/85	10/28/87	NA
Manchester United Methodist	Manchester, MO 63011	1/1/84	1/1/84	11/24/92	NA
Minker/Stout/Romaine Creek	4037 W. Rock Creek Rd., Hillsboro, MO 63052	2/13/84	6/14/84	7/26/99	NA
Moberly FMGP	501 Franklin St., Moberly, MO 65270	11/20/02	1/14/03	6/30/14	NA
Modern Iron And Metals	7101 N. Market St., Pagedale, MO 63133	6/10/87	8/17/87	8/27/91	NA
Monsanto-Queeney	1700 S. Second St., St. Louis, MO 63177	2/13/84	NA	NA	4/10/97
Motoroloa-Webb City	17th and W, Hall St., Webb City, MO 64804	6/24/86	NA	NA	6/29/00
Nevada Landfill	Nevada, MO	1/30/86	NA	NA	12/4/86
Parkhurst Mfg. Co.	2503 W Broadway Blvd., Sedalia, MO 65301	8/29/83	NA	NA	11/1/83
Payne Residence	4038 Rock Creek Rd., Imperial, MO 63052	8/27/83	1/3/84	10/1/86	NA

Removed or Action Suspended

Registry Sites Removed/Action Suspended

Piazza Road/ Bliss Farm	Rosati, MO 65559	8/26/83	3/10/87	12/28/90	NA
Plattco Landfill – Douglass Property	Parkville, MO 64152	4/19/85	NA	NA	7/15/87
Private Drive Off Highway 100	Boone's Lane, Junction Highway 100 and T, Glencoe, MO 63017	2/10/84	6/14/84	1/15/88	NA
Quail Run Mobile Manor	E. Highway 100, Gray Summit, MO 63055	8/26/83	NA	NA	3/17/89
Quality Metal Finishing- Commercial Ave.	2055 N. Commercial Ave., St. Clair, MO 63077	8/14/03	10/13/03	3/2/12	NA
Rall Leasing	200 Enterprise Dr., Cuba, MO 65453	6/15/92	7/25/95	6/10/19	NA
Ray County Drum	2.5 miles east of Regal, Regal, MO 64035	5/25/84	NA	NA	5/1/85
Reeves Property	Fredericktown, MO 63645	5/20/87	NA	NA	11/15/93
Robbins Property	Route 3, Highridge, MO 63049	2/10/84	6/14/84	12/9/92	NA
Roscoe	Roscoe, MO 64776	1/23/89	NA	NA	4/27/00
Rusha Farm	One mile SW of Verona, Verona, MO 65712	8/27/83	1/3/84	9/8/87	NA
Sac River Landfill	Hwy 13, Springfield, MO 65802	8/26/83	1/15/84	6/30/16	NA
Saddle & Spur Riding Club	Little Antire Creek Rd., Highridge, MO 63049	8/27/83	1/15/84	8/9/90	NA
Saline Creek Site	3/4 mile northeast of Murphy, Murphy, MO 63206	8/27/83	NA	NA	6/1/84
Shenandoah Stables	Highway 61 S., Moscow Mills, MO 63362	8/30/83	1/3/84	8/21/89	NA
Solid State Circuits - Boonville Road	616 Boonville Rd., Springfield, MO 65806	7/12/90	NA	NA	8/26/96
Southern Cross Lumber	143 McDonnell Blvd., Hazelwood, MO 63042	8/31/83	2/22/85	3/9/88	NA

Removed or Action Suspended

Registry Sites Removed/Action Suspended

Southwestern Bell/Eureka	Stonegate and Williams Rds., I-44, Eureka, MO 63025	3/17/87	NA	NA	4/27/00
Star Brite Plating-Joplin (Mid States Motor Carriers Inc.)	610 Tyler Ave., Joplin, MO 64801	5/16/90	NA	NA	4/27/00
Star Brite Plating-Joplin	510 Tyler Ave., Joplin, MO 64801	5/15/90	NA	NA	8/5/03
Stephens Farm	13688 Ozark Rd., Neosho, MO 64850	3/8/91	5/23/91	1/4/99	NA
Sullins Residence	1680 Romaine Creek, Fenton, MO 63026	8/27/83	NA	NA	10/10/85
Talley Farm	McKinley, MO 65705	2/8/84	NA	NA	12/3/85
Timberline Stables	Route MM, New Bloomfield, MO 65063	8/29/83	1/1/84	1/29/89	NA
Times Beach	I-44 east of Eureka, Times Beach Disincorporated, MO 63025	3/5/84	4/5/84	4/28/99	NA
TSI Mulberry Hill Road	Mulberry Hill Rd., Barnhart, MO 63051	9/3/83	1/3/84	1/18/91	NA
TWA (Ground Operations Center)	KCI Airport, Kansas City, MO 64153	10/14/86	NA	NA	6/14/01
Wheeler Property	107 E. Pine, La Monte, MO 65337	8/29/83	NA	NA	9/17/84
Wheeling Disposal	Off Hwy K, 1-mile south of Amazonia Amazonia, MO 64421	8/29/1983	1/1/1984	6/30/2016	NA

**REGISTRY OF CONFIRMED
ABANDONED OR
UNCONTROLLED HAZARDOUS
WASTE DISPOSAL SITES
FISCAL YEAR 2022**

SITE SUMMARY INDEX

Site Name

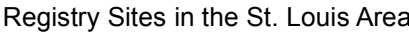
1. ACME Battery
2. AMERECO Environmental Services
3. Amoco Oil-Sugar Creek Refinery
4. A.P. Green
5. ARMCO
6. Armour Road
7. Baldwin Park
8. Bee Cee Manufacturing
9. BFI-Missouri City Landfill
10. Bliss Property at the Ellisville Area
11. Chevron Chemical Company
12. Chillicothe FMGP
13. Conservation Chemical
14. Denney Farm (Capped Trench)
15. Farmland Industries
16. HCI Chemtech-Birmingham Road
17. HCI Chemtech-Springfield
18. HCI Chemtech-St. Louis
19. HCI Chemtech-Stillwell Street
20. Independence FMGP #1
21. Jones Truck Lines
22. Joplin Oil Ponds
23. Lake City Army Ammunition Plant
24. Lake Lotawana Sportsmen's Club
25. Lebanon Phosphorus Spill
26. Lee Chemical
27. Minker Property
28. Modine Manufacturing
29. Neosho Digester and Trenches
30. Nufarm
31. Old Centralia Landfill
32. Overnite Transportation
33. Pigeon Hill Landfill
34. Prier Brass
35. R&O Processors—Hwy 60
36. R&O Processors/Lux Theatre
37. Reichhold Chemical
38. Rheox, Inc
39. Riverfront Landfill
40. Sentinel Wood Treating
41. Solid State Circuits
42. St. Charles FMGP
43. Stratman Lumber
44. Syntex-Springfield
45. Syntex-Verona (East)
46. Syntex-Verona (West)
47. Thompson Chemical/Superior Solvents
48. Tillman House
49. Todd Site
50. Trenton Landfill
51. Turner Salvage
52. Union Carbide

SITE SUMMARY INDEX

Site Name

- 53. University of Missouri-South Farm
- 54. West Lake Landfill
- 55. Zykan Property

- Registry Site (Numbers correspond to sites listed on Site Summary Index Pages)



CLASS 1 SITES

Lake City Army Ammunition Plant

Site Name: Lake City Army Ammunition Plant (LCAAP)

Classification: Class 1

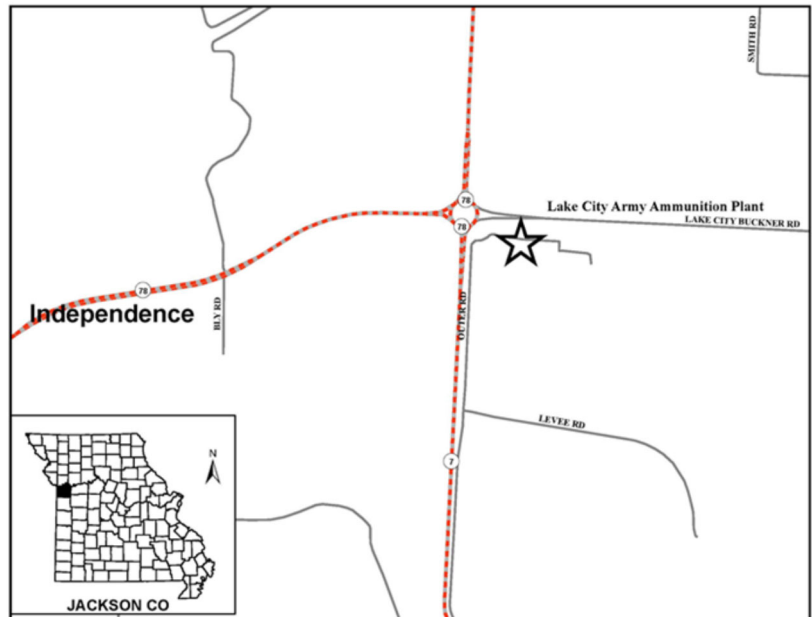
Date of Registry Placement: March 2, 2001

Date of National Priorities List Listing: July 22, 1987

Site Address: 25201 Highway 78 East Independence, Jackson County, MO, at the intersection of Route 7 and Route 78 Highway

Present Property Owner: U.S. Government, Department of the Army (Army)

Lead Agency: U.S. Environmental Protection Agency Region 7 (EPA) [Corrective Action]; Missouri Department of Natural Resources (Department) [Operations]



Waste Type: Metals, Volatile organic compounds, Semi-volatile organic compounds, Explosives, Polychlorinated Biphenyls, Polyfluoroalkyl substances, Asbestos, and Radioactive waste.

Quantity: 2.04-3.7 million pounds volatile organic compounds in subsurface; Undetermined quantities of metals, and explosives; and 30,000 cubic yards of radioactive waste.

Site Description and Environmental Concern:

The Lake City Army Ammunition Plant (LCAAP) site is the largest small arms ammunition plant in the nation. Past industrial operations generated large quantities of hazardous waste, including: solvents; explosives; heavy metals such as arsenic, barium, cadmium, chromium, lead, mercury, and silver; and depleted uranium. Since 1941, the facility disposed of operational wastes in lagoons, landfills, and burn pits located throughout the 6-square-mile facility. Current disposal practices are subject to state and federal regulations.

The LCAAP site is a 3,935-acre government-owned, contractor-operated plant that began operation in 1941. The site is located in the Lower Missouri-Crooked Watershed, at the mouth of the Little Blue River. The site has 34 areas of concern, which compose four operable units: Northeast Corner Operable Unit; Area 18 Operable Unit; Area 10 Sand Piles Operable Unit; and, Installation-Wide Operable Unit (IWOU).

The LCAAP site is actively storing and treating hazardous wastes. Olin-Winchester operates the site, managing 12 hazardous waste container storage areas, with a combined capacity of 192,970 gallons, and one explosive waste incinerator, with a treatment rate capacity of 2,100 pounds of explosives per hour. Volatile organic compounds, explosives, and heavy metals have contaminated groundwater, surface water, and soil at the site. Contaminants in the groundwater plume migrated beyond the facility's northeast corner boundary in the past; however, the current pump-and-treat system hydraulically contains the groundwater plume on-site.

The Army completed the fourth five-year review (FYR) for the site in August 2020. The review concludes that the environmental remedies currently in place at the site are protective of human health and the environment. The report also lists recommendations related to ensuring that site conditions remain protective over the long term. The recommendations include revising several cleanup goals based on updated toxicity data and exposure assumptions, continuing investigation of per- and polyfluoroalkyl releases and developing a revised groundwater remedy for Northeast Corner Operable Unit Area 17B to achieve more reasonable

cleanup timeframes.

Remedial Actions:

Northeast Corner Operable Unit (NECOU): The Northeast Corner Operable Unit consists of Areas 11, 16, and 17, and two areas governed by the Resource Conservation and Recovery Act (RCRA). The U.S. Environmental Protection Agency (EPA), Missouri Department of Natural Resources (Department), and the U.S. Army signed a Record of Decision (ROD) for remedial action in September 2007. A 2018 Timeframe Memo concluded that the selected remedies for these areas will result in unacceptable remedial timeframes greater than 100 years. The Army is evaluating other remedial technology options as part of a 2019 Army contract for determination and selection of alternate remedial technologies that can meet remedial design criteria. The selected remedy for each of the areas in the Northeast Corner Operable Unit follows.

RCRA Areas: Waste Oil and Solvent Storage Facility and Paint and Solvent Waste Storage Facility – Surficial Soil – excavation and off-site disposal of surficial soil with chemicals of concern that exceed cleanup goals. Institutional controls are required to maintain industrial land use.

Area 11 Burning Ground: Surficial soil – institutional controls are required to maintain industrial land use. Groundwater – monitored natural attenuation for cyclonite and perchlorate. Institutional controls are required to prevent groundwater use and to maintain industrial land use.

Area 16A Abandoned Landfill: Groundwater – monitored natural attenuation for semi-volatile organic compounds, and institutional controls to prevent groundwater use and to maintain industrial land use. Groundwater seeps – groundwater seep monitoring to ensure compliance with cleanup goals, landfill cover inspection and maintenance, and institutional controls related to the landfill management (e.g., no construction of buildings on landfill) and to maintain industrial land use.

Area 16B Solvent Pits – enhanced reductive dechlorination via an in-situ reactive zone in the source area. Groundwater - monitored natural attenuation and institutional controls to prevent groundwater use, to prevent activities that could result in vapor exposure, and to maintain industrial land use.

Area 16C (Old Firing Range), 16D (Old Burning Grounds), and 17C (Burning Pad): Surficial soil – lead hot spot excavation and consolidation with soil in Area 17D. Institutional controls are required to maintain industrial land use.

Area 17D Waste, Glass, Paint, and Solvents Area: Focused excavation and consolidation of lead-impacted soil in areas susceptible to erosion; in-situ stabilization or excavation and off-site disposal of lead-impacted surficial soil with concentrations greater than 10,000 parts per million (ppm); vegetative cover of lead-impacted surficial soil exceeding the cleanup goal of 1,197 ppm; vegetative cover over litter; litter removal; maintenance and performance monitoring of the permeable reactive wall; enhanced reductive dechlorination source treatment via an in-situ reactive zone; phyto-system to minimize surfacing of groundwater near the permeable reactive wall and to provide hydraulic control of groundwater flow near the permeable reactive wall; monitored natural attenuation; operation of Well 17-S; and, institutional controls to prevent activities that could result in vapor exposure, prevent building/construction on soil covers, and maintain industrial land use.

Area 17B Oil and Solvent Pits: Zero-valent Iron source treatment via deep soil mixing; maintenance/repair of the existing vegetative cover to minimize infiltration; enhanced reductive dechlorination source treatment via an in-situ reactive zone; monitored natural attenuation within the source area to monitor ongoing enhanced reductive dechlorination processes; sentinel/monitoring wells to monitor for non-aqueous phase liquid migration; monitored natural attenuation of the downgradient groundwater volatile organic compound plume; enhanced reductive dechlorination via an in-situ reactive zone barrier to prevent migration of the volatile organic compound plume to the inactive stream channel and increase rate of plume degradation; and, institutional controls for restriction of land use and prevention of consumption of contaminated groundwater.

Area 18 Operable Unit: Area 18 consists of a series of oil and solvent pits, and burn areas where a large quantity of spent solvents and other wastes were disposed of. EPA, the Department, and the Army signed the original ROD in 1999. During post-1999 ROD activities, observed site conditions were different than originally thought, and the ROD was amended in 2007.

The 2007 amended ROD provided for additional investigation to further understand the nature and extent of contamination. The investigation discovered additional impacts to surface soil and the volatile organic compound source area mass. The volume of surface soil contaminated with lead above the cleanup goal increased from 4,700 cubic yards to approximately 9,700 cubic yards. The volatile organic compound contaminant mass in the source area increased from less than 50,000 pounds delineated to only 20 feet below ground surface, to a low-range estimate of more than 1 million pounds delineated to approximately 30 feet below ground surface. The dominant factor accounting for the increase of the volatile organic compound mass estimated to be present in Area 18 Operable Unit is the presence of non-aqueous phase liquid in the shallow volatile organic compound source areas.

The implementation of remedies for Area 18 Operable Unit are as follows:

- Focused in-situ stabilization of lead-impacted surface soil.
- Installation of in-situ reactive zone barriers in the inactive stream channel downgradient of each volatile organic compound source area to contain the contaminant source.
- Focused soil excavation, installation of non-aqueous phase liquid recovery wells, monitored natural attenuation, and in-situ reactive zone treatment in the volatile organic compound source areas.
- Installation of a vegetative cover to limit the potential for exposure to lead-impacted surface soil and impacted soil in the volatile organic compound source areas.
- Continued operation and optimization of the existing on-site groundwater extraction and treatment system and monitored natural attenuation of groundwater.
- Land-use controls (LUC) to limit the potential for exposure to lead-impacted surface soil and impacted soil and groundwater in the volatile organic compound source areas.

The Interim Remedial Action Completion Report for Area 18 and the Installation-Wide Operable Unit (IWOU) was completed in June 2010.

IWOU: The IWOU encompasses 30 areas of concern, and covers the remaining facility property, except for the Area 10 Sand Piles and Area 27 Active Firing Range. The selected remedy consists of monitored natural attenuation with LUCs to ensure land use remains industrial and groundwater use is restricted.

In 2008, EPA and the Responsible Parties signed the ROD for the IWOU, and the selected remedies were as follows:

- Area 2: Focused soil excavation and off-site disposal of lead-impacted soil to protect site and construction workers from potential exposure and to prevent potential leaching to groundwater.
- Area 3: Vegetative cover and LUCs to prevent potential exposure of human and ecological receptors to polycyclic aromatic hydrocarbons and to metals-impacted soils.
- Area 9: Focused soil excavation and off-site disposal of lead- and TCE-impacted soil to protect site workers from potential exposure.
- Area 13: Focused soil excavation and off-site disposal of metals-impacted soil to protect site workers from potential exposure.
- Area 23: Implementation of LUCs to protect construction/utility workers from potential exposure to manganese in wind-blown fugitive dust.
- Area 30: Vegetative cover and LUCs to prevent potential exposure of human and ecological receptors to metals-impacted soils.
- Area 34: Focused soil excavation and off-site disposal of metal- and explosive-impacted sediment to prevent potential exposure of ecological receptors to sediment, and to prevent potential leaching to groundwater.
- Areas 4, 7, 13, 15, 19, 21, and 33: LUCs to prevent exposure to contaminated soil associated with inactive sumps located next to production buildings or areas that prohibit removal of the sumps at this time. The following sumps will require work as they become available through maintenance or construction activities, or at installation closure or transfer: 1SU2, 3SU3, 33CSU1, 33DSU1, 34BSU1, 34DSU1, 52ASU1, 52BSU1, 97ASU2, and 136ASU1. In addition, five inactive, abandoned sumps at Area 13 are beneath

buildings (35SU10 through 35SU14). These sumps were either filled or removed during construction activities and were not part of the removal action. It may be determined that these sumps require additional work, as access to them becomes available due to construction, maintenance, or at installation closure or transfer.

IWOU Groundwater: Monitored natural attenuation, LUCs, groundwater extraction and ex-situ treatment, and installation of an in-situ treatment system at Area 12 via enhanced reductive dechlorination to prevent potential exposure of human receptors to groundwater. The Army finalized the Interim Remedial Action Completion Report in June 2010.

Building 83 Area: In the Third FYR, OU5 is the former Building 83 area. Following the demolition and removal of Building 83 in 2017, the area became part of the IWOU through the November 2019 Explanation of Significant Differences (ESD), which then closed OU5. Constructed around 1942, the Army previously used Building 83 as a production building for Trinitroresorcinol. Trinitroresorcinol is the precursor to lead styphnate, an explosive propellant used in the production of ammunition. The building was characterized as a very dangerous and high explosive potential. The contaminants of concern for this building were asbestos, mercury, lead, PCBs, and explosives. LUCs remain in effect. The area was backfilled, graded, and seeded. Site restoration is complete. The Department and EPA will continue area inspections as part of the IWOU.

Area 10 Sand Piles Operable Unit: Due to the underestimation of waste material, the project did not receive the required funding for remediation of the Area 10 Sand Piles Operable Unit under a Nuclear Regulatory Commission Decommissioning Plan. The Nuclear Regulatory Commission deferred regulatory oversight to EPA Region 7 and the Department. Major contaminants of concern include depleted uranium, lead, and unexploded ordnance. The Federal Facility Agreement Parties, made up of the Army, EPA, and the Department, agreed to make Area 10 Sand Piles a separate operable unit. In 2005, the Army, EPA, and the Department agreed to pursue a Non-Time-Critical Removal Action to address chemical and radiological contamination at Area 10. The Army issued the Area 10 Sand Piles Engineering Evaluation/Cost Analysis in October 2005. This document presented the basis for the proposed removal action by characterizing the site conditions and associated risks, evaluating potential removal action alternatives, identifying cleanup levels, and recommending a suitable removal action approach to address the lead- and depleted uranium-impacted sand and soils.

In January 2008, EPA and the Department prepared an ESD to document a revised cleanup level for lead that was consistent with the ammunition plant's site-wide cleanup level under an industrial scenario. A Revised Final Area 10 Sand Piles Action Memorandum, dated August 2008, documents regulatory approval of both the Non-Time Critical Removal Action, outlined in the Engineering Evaluation/Cost Analysis, and the final cleanup level for lead under an industrial scenario. The removal action on the bullet catcher sand piles that addressed radioactive materials, required as part of the decommissioning activities, and nonradioactive constituents, was completed Dec. 31, 2008. A Removal Action Completion Report and Final Status Survey was completed in March and June 2009. The material was hand-sorted and the unexploded ordnance hydrocut to render it non-explosive. All other waste streams from the sorting and cleanup process were properly disposed of off-site. In 2015, an amendment to the ammunition plant's Nuclear Regulatory Commission license occurred.

Involved parties finalized an ESD in November 2020 to document changes to the selected remedy presented in the IWOU ROD. The ESD addressed changes in LUCs at Area 8, soil cleanup goals (CUGs) for manganese at Area 23, and CUGs for manganese in groundwater and surface water. The Area 8 LUC change added Areas 8E and 8F to LUCs previously established for Areas 8-A through 8-D. The industrial/commercial worker scenario was the basis for the original Area 23 soil CUG for manganese of 19,000 parts per million (ppm). The revised CUG for manganese in soil, established in the ESD, set the site background value of 1,777 ppm. EPA changed the manganese CUG for groundwater from 3,800 parts per billion (ppb) to the background value of 1,492 ppb after reevaluation of site groundwater data. Similarly, they changed the 3,800 ppb surface water CUG to 1,782 ppb. The NECOU ROD addresses the groundwater and surface water CUGs for manganese. The revised groundwater and surface water CUGs also will be included in an upcoming ESD for the NECOU.

Site representatives removed 67 dead trees in winter 2020, and an estimated 50 additional trees appeared to be dead or dying. The impacted trees are a non-native poplar variety, and boring insect infestation was obvious in many of them. Nearby cypress trees in the phytoremediation area did not appear to be impacted.

LCAAP representatives consulted with a local Missouri Department of Conservation forester and, based on their recommendations, decided to replant bald cypress, swamp white oak, or silver maple trees as they removed dead/dying poplar trees.

On Aug. 30, 2022, the Department conducted a Fiscal Year 2022 annual site inspection during which inspectors noted very little change in conditions.

General Geologic and Hydrologic Setting:

The site is located near the boundary between the Osage Plain and Dissected Till Plains of the Central Lowland Physiographic Province. The surface topography in the vicinity of the plant consists of rolling uplands traversed by broad stream valleys and flood plains of the Missouri River, the Little Blue River, and an inactive stream channel. The majority of the active manufacturing areas are in the topographically flat portion of the site. Surface water draining from the western portion flows to West Fire Prairie Creek and eventually into the Little Blue River. Surface drainage from the eastern portion flows to East Fire Prairie Creek and eventually into the Missouri River.

At the highest elevations, limestone of the Pennsylvanian-age Kansas City Group is the predominant bedrock. Underlying side slopes, shale and claystone with lesser amounts of limestone of the Pennsylvanian-age Pleasanton Group dominate. Bedrock beneath the alluvial channel is limestone of the Pennsylvanian-age Marmaton Group. Soils overlying bedrock in the upland area range in thickness from 2 to 5 feet and typically are composed of silty clay and silt. In the central and northern parts of the installation, the soils are composed of silty clay and silt about 5 feet thick. Pleistocene-age alluvial deposits of silt, clay, sand, and gravel fill the inactive stream channel to depths of up to 90 feet.

The principal aquifer of the LCAAP site is the unconsolidated Pleistocene-age alluvial deposits, specifically the coarse sand and gravel in the lower 40 to 70 feet, located in the inactive stream channel. The LCAAP site and nearby residents use the alluvial aquifer for basic drinking and industrial water needs. The pumping of production wells has altered the natural groundwater flow patterns. The non-pumping groundwater flow directions have been to the east and west, with a groundwater flow divide near the central portion of the site. Recent potentiometric data indicate an apparent northwest-southeast groundwater flow divide located along the eastern quarter of the inactive stream channel. West of the divide, groundwater flows in a generally westward direction (influenced by site pumping) within the abandoned channel.

Across the site, the average depth to the water table is 5 feet below the ground surface in the alluvial flats. The average depth to the water table in the uplands is 7 feet below the ground surface. The site alluvial aquifer is in hydraulic connection with the Little Blue River alluvium and the Missouri River alluvium. The principal concern is the potential for lateral off-site migration of hazardous wastes through the alluvial materials. Groundwater in the Pennsylvanian-age bedrock underlying the site is a minor component of the overall regional groundwater flow regime.

Public Drinking Water Advisory:

Fourteen active public drinking water wells provide water to the LAACP facility, and all 14 wells draw water from a shallow alluvial aquifer that underlies the site. A water treatment plant processes the well water before it is distributed for human consumption or process use. The treatment plant influent and effluent are tested periodically to verify that site-related contaminants are below drinking water standards. Site-related contamination has not been detected above drinking water standards in the treatment plant effluent; however, human health risk remains a potential concern. The site's northwest lagoon area is located nearly at the well field's center of concentration and lies within 0.5 mile of six of the 12 wells. Because alluvial aquifers often exhibit relatively rapid groundwater flow, it is possible that dramatically increased (or decreased) pumping from one or more wells could alter the groundwater flow regime and influence lateral or vertical migration of contaminated groundwater. Due to verified surficial and groundwater contamination at the site and the spatial distribution of wells relative to on-site contamination, all 14 system wells are considered highly vulnerable to contamination.

Health Assessment:

The following are the major contaminants of concern found in surface water, groundwater, or soil at the site:

antimony, arsenic, benzo(a) anthracene, benzo(a)pyrene, benzo(b) fluoranthene, benzo(k)fluoranthene, cadmium, 1,2-dichloroethene, 1,3-DNB, lead, PCE, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, TCE, vinyl chloride, and 1,3,5-trinitro-1,3,5-triazine. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

A public health risk exists on-site, due to the toxicity of the hazardous chemicals and the levels of surface soil, subsurface soil, and groundwater contamination. A public health risk also may exist off-site. Further groundwater and private well monitoring to determine the extent of hazardous waste off-site migration will enable public health officials to determine potential human exposure. Private well monitoring from 2004 through 2014 found no wells with contamination above established standards. However, due to the number of contaminant sources around the plant and the number of conduits to groundwater, the risk of drinking water contamination remains very high.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

CLASS 2 SITES

BFI - Missouri City Landfill

Site Name: BFI - Missouri City Landfill

Classification: Class 2

Date of Registry Placement: January 1, 1984

Site Address: 8501 Stillhouse Road,
Liberty, Clay County, MO

Present Property Owners: Owned by Missouri City Landfill, LLC, and Browning Ferris Industries (BFI) Waste Systems of North America, Inc., and operated by BFI Waste Systems of North America (BFINA), LLC

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Herbicide wastes, pesticide wastes, chrome sludge, paint thinners and strippers, and other industrial wastes

Quantity: Various businesses deposited approximately 160 million pounds of industrial wastes into hazardous waste landfill cells

Site Description and Environmental Concern:

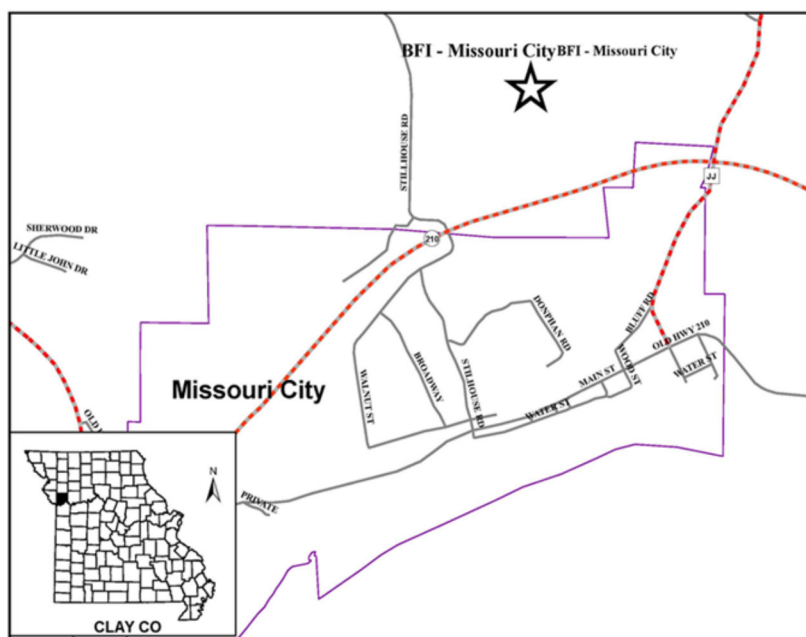
The BFI - Missouri City Landfill site is a closed industrial and solid waste landfill that discontinued operations in 1983. Past landfill operations have resulted in groundwater contamination and releases of volatile organic solvents and hydrocarbons to the intermittent stream on the property.

The privately-owned site is located on a bluff top above the Missouri River. Approximately 315 acres of buffer property surround the 90 acres of closed landfill. The property's unutilized portion is moderately wooded and undeveloped, and a security fence with a locking gate surrounds the entire facility. Land use in the surrounding area is primarily agricultural. The property owner operates an on-site water treatment plant that treats groundwater collected by the groundwater collection system, which is a component of the ongoing remedial actions.

In August 1972, Lincoln Brothers Land Inc. began operating a sanitary landfill on the facility property. In November 1972, BFI Inc. leased the property and continued to operate the sanitary landfill. The sanitary landfill accepted municipal wastes and certain industrial wastes, such as petroleum-refining sludge, until 1974. In 1974, BFI began constructing additional landfill cells and waste-processing units to dispose of bulk liquid sludge.

At least 160 million pounds of industrial wastes were disposed of in the hazardous waste landfill cells, including phenoxyacetic acid herbicide wastes, organophosphate pesticide wastes, chrome sludge, paint thinners and strippers, and other industrial sludge. The hazardous waste management processing units included a chemical processing center, a chemical landfill, two LiqWaCon™ gelatin basins, three sludge-drying beds, seven bulk sludge-disposal trenches, a wastewater treatment pond, and a stormwater-retention pond.

In September 1983, BFI discontinued waste-disposal operations and developed a closure plan for the landfill, which was approved by the U.S. Environmental Protection Agency (EPA) in December 1984. BFI closed



each hazardous waste management unit separately, and installed a multicomponent final cap over all the waste management units, addressing the entire area as one unit, collectively called the closed landfill.

From 1983 to 1991, BFI conducted several studies to investigate groundwater contamination related to releases from the landfill cells. BFI continues to monitor, evaluate, and manage contaminated groundwater under the Missouri Hazardous Waste Management Facility Part I Permit, which the Missouri Department of Natural Resources (Department) issued Aug. 14, 2017. In addition to groundwater contamination, investigations documented impacts to the intermittent stream on the permitted property, including volatile organic solvents and hydrocarbons.

Remedial Actions:

Based on site investigation results, BFI installed a leachate collection system and French drain to prevent off-property runoff and contaminant migration. During site closure activities, BFI installed a passive gas collection system for the sanitary landfill and the two gelatin basins. An active gas extraction system became operational in April 1988. Gas monitoring probes stopped detecting methane after one month of the gas collection system's operation. The gas collection system currently is inactive, but remains operable if future collection is necessary.

In 1996, BFI added an interceptor trench and collection sump to collect leachate where groundwater contamination was surfacing at outcrops along a ravine located southeast of the landfill and downgradient of the groundwater interceptor trench. In 1997, BFI addressed cap maintenance on the New Gelatin Basin and reshaped erosion letdown areas on the landfill's east side.

In 2010, BFI discovered a release of volatile organic solvents and hydrocarbons in the property's intermittent stream. BFI took environmental emergency response actions to reduce or eliminate any further impacts to surface water, conducted further investigations, and evaluated alternative measures to address the release. Between 2013 and 2016, BFI conducted interim stabilization measures. In 2013, BFI completed a stream bank interceptor trench to prevent contaminant migration to the intermittent stream. In 2014, BFI took measures to prevent rainwater from infiltrating behind the concrete plug on top of the stream bank interceptor trench. In 2015 and 2016, BFI excavated impacted stream bed material and constructed a collector system to mitigate the potential for future impacts to the stream bed and associated surface water.

On Aug. 14, 2017, the Department issued the final Missouri Hazardous Waste Management Facility Part I Permit for the BFI - Missouri City Landfill. The permit included provisions to construct and operate an on-site contaminated groundwater/leachate treatment plant.

BFI completed treatment plant construction and start-up testing in September 2018, and the plant became operational in October 2018. BFI stores the treated water in one of two constructed 250,000-gallon storage tanks, and samples the treated water prior to discharge. The sampling results must meet the discharge limits specified in the Missouri State Operating Permit, issued by the Department's Water Protection Program, before BFI can discharge the treated water to the permitted outfall.

On July 28, 2022, the Department conducted the Fiscal Year 2022 annual inspection and reported that the landfill cap is well maintained and monitoring wells along the southern border appear in good condition.

General Geologic and Hydrologic Setting:

The soil, which averages 15 to 20 feet in thickness, is composed of moderately- to highly-permeable loess. Contaminants that leaked into the permeable soil resurface downslope on the top of bedrock cropping out in surface drainage features. From there, surface water flow in tributaries can transport the contaminants onto the Missouri River alluvium, which recharges that important aquifer. Contaminants also could discharge directly into the Missouri River, though there has never been any evidence of this.

The bedrock beneath the facility consists of the Winterset Limestone and the Bethany Falls Limestone. A 5- to 7-foot sequence of shale is present between the limestone units. Several thin shale and limestone units are present beneath the Bethany Falls Limestone. Sandstone of the Pleasanton Group underlies these shales and limestone. All of the bedrock units, particularly the limestone, exhibit fracture permeability.

Public Drinking Water Advisory:

Missouri City purchases drinking water from Clay County Public Water System District (PWSD) 4. Clay County PWSD 4 purchases drinking water from Liberty PWS. Liberty PWS purchases drinking water from Kansas City PWS. Kansas City PWS purchases drinking water from North Kansas City PWS. Contaminant releases from the facility have not impacted any of these locations. The fact that Missouri City purchases water that originates from other distant public water systems also demonstrates that the local groundwater is not used extensively as a public drinking water source. Further, with the exception of Kansas City PWS, most of the drinking water comes from surface water sources.

The predominant use of groundwater and surface water adjacent to the facility property is for agriculture and livestock watering. A shallow hand-dug well (identified as WCON) and a spring (identified as WKIN) are located in the landfill's immediate vicinity. These water sources have not been used for human consumption since 1982.

Health Assessment:

Contaminants of concern at this site include phenoxyacetic acid herbicide wastes, organophosphate pesticide wastes, chrome sludge, paint thinners and strippers, and other industrial wastes. A solid waste landfill also located at the facility historically received municipal and certain industrial wastes. Please refer to the Health Assessment Chemical Table in Appendix A for a description of potential adverse health effects associated with these contaminants.

In 1998, samples from an off-site private well detected trichloroethylene (TCE). Samples collected by the Missouri Department of Health and Senior Services between 2001 and 2006 showed levels of TCE below EPA's maximum contaminant level of 5 parts per billion.

The landfill is formally closed and an engineered composite cover is in place. The cover effectively prevents direct human contact with the wastes. It also prevents surface water from reaching the wastes, which otherwise could contaminate the groundwater/leachate.

Based on available information, as long as the contaminated groundwater and surface water is managed appropriately in accordance with the Missouri Hazardous Waste Management Facility Part I Permit and the Missouri State Operating Permit, potential for human exposure to contaminants at this site is low, and presents no public health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Conservation Chemical Company

Site Name: Conservation Chemical Company (CCC)

Classification: Class 2

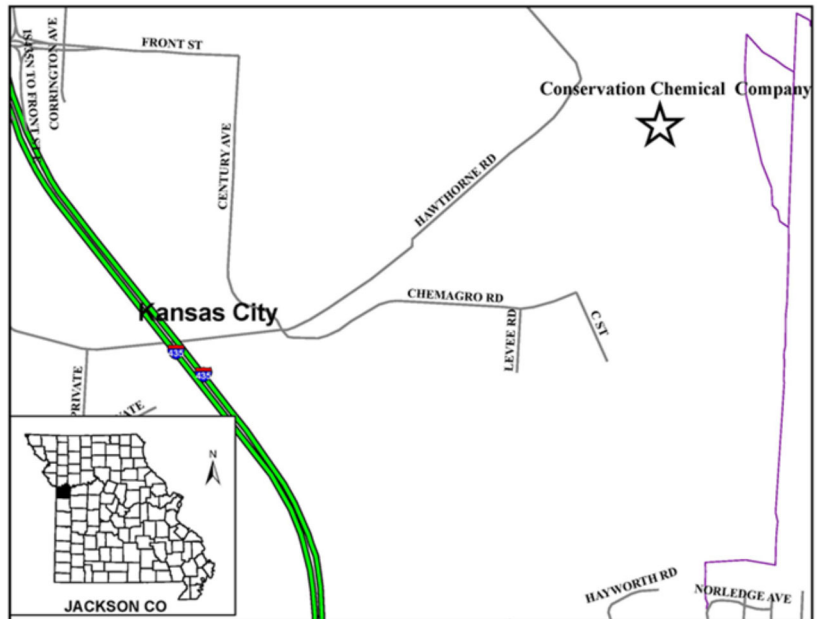
Date of Registry Placement: January. 9, 1984

Date of National Priorities List Listing: October 4, 1989

Site Address: 8900 Front Street, Kansas City, Jackson County, MO

Present Property Owner: Conservation Chemical Company

Lead Agency: U.S. Environmental Protection Agency (EPA)



Waste Type: Organic compounds, solvents, acids, caustics, metal hydroxides, cyanide compounds, pesticides, herbicides, waste oils, arsenic, and elemental phosphorus

Quantity: Estimated 93,000 cubic yards of material buried on site

Site Description and Environmental Concern:

The Conservation Chemical Company (CCC) site is a former chemical storage, disposal, and burial site. The industrial wastes disposed at the site, which included 1 ton of solid waste and about 48 million gallons of liquid and sludge waste, led to soil and groundwater contamination. CCC stored the wastes in six unlined pits and buried at least 8 feet deep.

The 6-acre site is located in an industrial area, about 1.75 miles east of Interstate 435 along Levee Road in Kansas City, Missouri. It is located in the flood plain at the confluence of the Missouri and Blue rivers on the river side of the levee. Groundwater depth varies from about 5 to 13 feet during periods of higher precipitation.

The CCC began operating at the site in 1960. Industrial wastes were disposed of at the site from 1962 to 1980. In 1975, the Missouri Department of Natural Resources (Department) investigated the operation and ordered it closed and cleaned up. In 1979, CCC closed the facility and fenced the entire property to restrict access. In 1980, the Department capped six on-site lagoons, then graded and vegetated the remaining sections of the site area as part of surface cleanup.

From 1979 through 1984, the U.S. Environmental Protection Agency (EPA) conducted site investigations, and the responsible parties conducted remedial investigations in 1984. Major contaminants found in the groundwater included phenols, heavy metals, and organic compounds. Given the depth of buried solid waste and the site area's variable water table depth, the sampling results indicate that groundwater directly contacted solid wastes during wetter seasons, then the contaminants entered the groundwater and migrated off site. Since some of the wastes were hazardous and explosive in nature, the responsible party solidified the lagoons with fly ash rather than dewatering and excavating them during post-closure activities.

Remedial Actions:

In September 1987, EPA signed the Record of Decision. The selected remedy included five actions: (1) surface cleanup, including demolition and disposal of existing buildings, tanks, and debris: (2) installation of a

two-layer protective surface cap over the existing fill consisting of stable loess and topsoil: (3) installation of an extraction well system to achieve an inward groundwater gradient, which will be measured by piezometer pairs along the site's perimeter; (4) installation of a groundwater treatment system; and, (5) off-site groundwater quality and water level monitoring to assess changes in the groundwater quality around the site.

In April 1988, EPA and Front Street Remedial Action Corporation (FSRAC) signed a Consent Decree (CD). The CD required annual meetings among EPA, the Department, and FSRAC to review remedial activity status. Further, the CD required the FSRAC to submit reports for: (1) the State Operating Permit; (2) Off-site Groundwater Monitoring; (3) Metals Removal; and, (4) Groundwater Level Monitoring. FSRAC also must prepare an annual operating summary at the end of each calendar year and present it to EPA and the Department at the annual meeting.

The CD specified that FSRAC must inspect the surface cap on a regular interval, perform maintenance activities, and ensure no excavation occurs; EPA must approve any excavation into the surface cap. Wastes generated by the treatment plant must be disposed of properly. FSRAC must regularly perform sampling and monitoring of the extraction and monitoring wells and piezometers.

Based on the CD, FSRAC constructed the remedial action in three phases from 1988 to 1990. The groundwater extraction well system met the expected inward gradient requirements until August 2000. However, multiple conditions, including the Missouri River's low water stage, led to problems maintaining the inward gradient used to contain the groundwater plume. In October 2004, FSRAC completed evaluating the extent of the groundwater plume. The study showed that the system maintained hydraulic control of the plume even with the inward gradient failure. In addition, the metal concentrations decreased within the influent stream over the years.

In 2009, EPA and the Department approved a work plan to allow FSRAC to investigate ways to optimize the groundwater extraction and treatment system (GETS) and eliminate the metal precipitation in the system. FSRAC conducted the optimization test and presented the results. In 2010, EPA approved the system for operation without the metal precipitation system.

On Sept. 21, 2017, EPA completed the fourth Five-Year Review (FYR) Report, which determined that the remedy adequately protected human health and the environment. The landfill cover prevented receptor exposure to waste materials and the GETS limited lateral off-site contaminant migration.

The site currently operates using a hydraulic containment remedy described in the 1987 Record of Decision (ROD) and the 1987 CD. FSRAC completed construction of the GETS on Dec. 1, 1989, and EPA certified it operational in June 1990. FSRAC was required to operate the GETS system for at least 30 years before recommending evaluation of the remedy's effectiveness. Discussions are ongoing to determine the site's status while the GETS continues to operate.

In October 2020, FSRAC conducted fieldwork as part of an investigation to determine whether a scour hole exists in bedrock at the site. FSRAC finalized their report based on EPA's and the Department's initial review and comments. On Dec. 3, 2020, FSRAC notified the agencies of an interruption in the operation of their hydraulic containment system and treatment facility due to a city maintenance accident that severed power lines. The city restored power within 24 hours. In May 2021, FSRAC submitted a Groundwater Model report to optimize site management. The groundwater model-based management aims to improve hydraulic compliance. FSRAC also characterized the nature and extent of volatile organic compounds near the site boundary.

On Nov. 4, 2021, EPA started the fifth FYR to evaluate the remedy's effectiveness and protectiveness. The fifth FYR identified achieving remedy completion with the GETS technology alone will be difficult because GETS focuses on maintaining hydraulic containment and not contaminant removal. For the remedy to be protective of human health and the environment long-term, FSRAC will need to evaluate other viable remedial alternatives or augmentation of the GETS. EPA will complete the fifth FYR in September 2022.

On July 28, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which inspectors observed a well-maintained site.

General Geologic and Hydrologic Setting:

On-site soil thickness is greater than 100 feet and composed of alluvial sand, silt, and clay. Typically, the grain size of these materials increases with depth. Bedrock is principally composed of interbedded shale and limestone, but is relatively unimportant in considering groundwater contamination potential because of the bedrock's low permeability and great depth.

The alluvial aquifer is an excellent water source. The water table's elevation fluctuates, depending on the Missouri River's water level. The direction of normal groundwater flow beneath the site is anticipated to be northeast toward the river. During flood stage, however, the river recharges the groundwater.

The principal concern at this site is the potential for lateral migration of hazardous wastes off-site. Subsurface contaminant migration through alluvial materials to the Missouri River is occurring.

Public Drinking Water Advisory:

The city of Independence's public water well field is located in the Missouri River alluvium, about 4 miles downstream. The nearest water system with an intake in the Missouri River is Lexington, 36 miles downstream. Any releases from the site would affect the Missouri River's water quality, but would pose little threat to downstream public water systems due to dilution and natural purification.

Health Assessment:

The following are the major contaminants of concern: benzene; cyanide; vinyl chloride; methylene chloride; 1,1,1-trichloroethane; trichloroethylene; 1,2-dichloroethane; chloroform; lindane; phenol; mercury; chromium; lead; arsenic; cadmium; and nickel. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The closest public water supply is 4 miles downstream. Private drinking water wells are closer; however, they are shallow alluvial wells located on the other side of the Missouri River. The closest use of groundwater is at Bayer Chemical-Agriculture Division Headquarters, which uses water from a well at its facility to dilute wastewater prior to release.

Based on available information, this site does not appear to present a significant public health risk, as long as the cap's integrity is maintained. For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

HCI Chemtech - Birmingham Road

Site Name: HCI Chemtech-Birmingham Road

Classification: Class 2

Date of Registry Placement: March 5, 1999

Site Address: 6301 Northeast Birmingham Road, North Kansas City, Clay County, MO

Present Property Owner: Brenntag Mid-South, Inc. with a portion of the site on Cerner Corporation property

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)

Quantity: Not determined

Site Description and Environmental Concern:

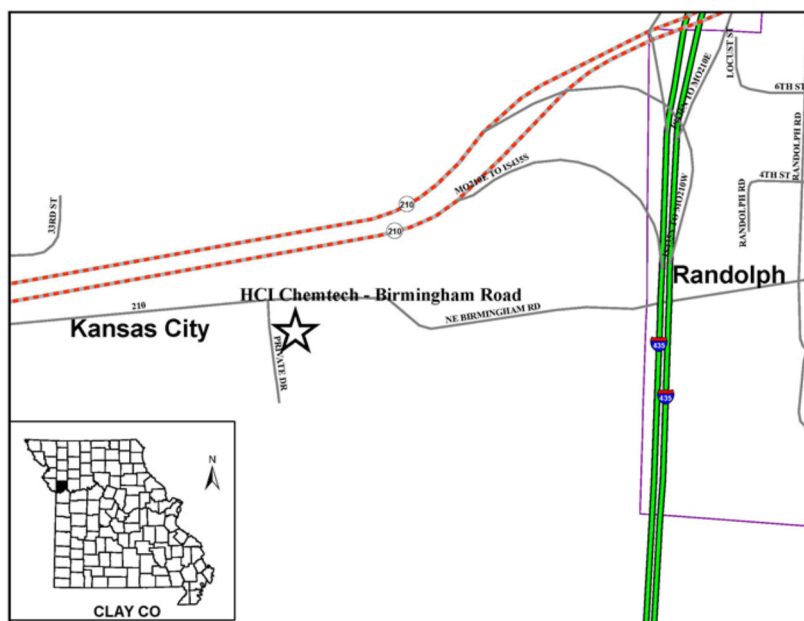
The HCI Chemtech-Birmingham Road site is a bulk chemical storage and distribution facility that has operated since 1968 under various companies. Volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) contaminate the soil and groundwater at the site.

The site is located in a small industrial area. The facility, owned and operated by Brenntag Mid-South, Inc., encompasses 11 acres situated along the northern bank of the Missouri River. The site is located in a 20-year flood plain. The facility is fenced with a security gate. On-site structures include an office, warehouse, maintenance buildings, boiler heating facilities, laboratory, and tank farms containing aboveground storage tanks. An eastern portion of the site is on property owned and operated by Cerner Corporation. The Cerner property consists of the former chemical storage warehouse, a small office building, and a vegetated tract of land. East of this property is a former casino, owned by Cerner as a training campus. A grain elevator property bounds the site on the west, and residences are located about 1,000 feet north of the site.

During previous operations, trucks, barges, and railcars delivered bulk chemicals to the HCI Chemtech-Birmingham Road facility, where they were stored in as many as 66 aboveground storage tanks. Until 1995, when the floors were paved with concrete, 46 of those tanks were located in containment areas with earthen floors.

The facility has a history of hazardous material spills and releases dating back to the 1970s. In 1992, an explosion on site killed three employees who were welding near a tank emitting anhydrous ethanol vapors. Past spills are the probable source of soil and groundwater contamination. The most serious release occurred in 1995, when at least 13,000 pounds of rayon-grade sodium hydroxide released on site. HCI Chemtech, the facility owner at the time, diluted this material with water and released effluent with a pH of 12.8 into the Missouri River.

In 2000, Brenntag purchased HCI Chemtech. Only nine of the aboveground storage tanks are active. Current storage and handling activities are restricted to caustics, asphalt, and diesel emission fluid due to the transfer of some operations to the HCI Chemtech-Stillwell Street facility.



Site investigations performed by various property owners over time show that VOC concentrations are above health-based screening levels in soil and groundwater. The pH of shallow groundwater ranges from 6.85 to 11.9. A significant potential exists for site-related contaminants to release to the Missouri River during a flood event. Groundwater-to-surface water discharge also is likely. Groundwater generates seepage along the river bluff, and this seepage discharges into the Missouri River. From 1993 through 2012, the Missouri Department of Natural Resources (Department) issued a number of notices and warnings to the facility owners, due to violations of hazardous waste management, air pollution, and wastewater discharge permits.

Remedial Actions:

Following a September 1995 release of sodium hydroxide, the U.S. Department of Justice indicted HCl Chemtech for criminal violations of the Clean Water Act, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Resource Conservation and Recovery Act (RCRA). HCl Chemtech pled guilty to one violation of the Clean Water Act, and the U.S. Environmental Protection Agency (EPA) placed them on probation. As a special condition of this probation, regulatory agencies required HCl Chemtech to adopt corporate and compliance monitoring programs for each of its Missouri facilities. In 1997, HCl Chemtech, the U.S. Attorney's Office, EPA, and the Department entered into a compliance agreement to investigate HCl Chemtech's sites.

In 1998, the Department completed a CERCLA preliminary assessment, which concluded that further CERCLA action was necessary. Pursuant to the 1997 compliance agreement, HCl Chemtech conducted remedial investigation work to help determine the extent of contamination. HCl Chemtech consultants conducted sampling in 2000, followed by quarterly groundwater monitoring for two years. The compliance agreement expired in fall 2000, when HCl Chemtech's probation ended.

In 2008, Brenntag, the Missouri Attorney General's Office, and the Department entered into an Abatement Order on Consent (AOC) for Remedial Investigation/Feasibility Study (RI/FS) of the site. The RI/FS is designed to determine the nature and extent of on-site contamination and evaluate alternatives for remedial actions, if any. Brenntag conducted a Phase II Remedial Investigation because the previous property owner had conducted some preliminary remedial investigation work.

From June 2000-2009, the groundwater monitoring network consisted of up to eight shallow monitoring wells, which Brenntag sampled for VOCs on a quarterly basis. The highest VOC levels were in the central portion of the site. In 2009, Brenntag replaced the monitoring wells and installed additional wells, bringing the network to a total of 14 wells, including two well couplets. The expanded monitoring well network better captures the contaminant plume's lateral and vertical extents. In May 2013, Brenntag transitioned to a semi-annual groundwater monitoring program.

On April 3, 2012, the Department approved Brenntag's Phase II Remedial Investigation and associated Human Health Risk Assessment and Ecological Risk Assessment reports, which were revised March 9, 2012. Additional information about the investigations and assessments are included herein and in the health assessment summary section. The investigations involved sampling and analysis of surface and subsurface soil, groundwater, sediment, surface water, and seep samples.

The 2012 remedial investigation confirmed four soil-source areas in the central portion of the site: aboveground storage tank area, former chemical storage warehouse, northern truck loading area, and rail loading rack. Groundwater characterization defined the extent of petroleum and chlorinated VOCs in groundwater to the north, east, and west. Dissolved-phase VOCs, at concentrations above screening levels, were entering the Missouri River along the site's southern boundary. Herbicide concentrations were not above screening levels. Therefore, the Department determined that additional investigation or remediation for herbicides is not necessary at the site.

The results of the ecological risk assessment indicated that no unacceptable risks from any current exposure scenarios or hypothetical future scenarios exist. The Department will revisit the ecological risk assessment assumptions if the property owner compromises the asphalt cap.

In 2013, Brenntag conducted a pilot test that confirmed the feasibility of soil vapor extraction/air sparge as a remedial option to address site contaminants and mitigate further leaching to groundwater. Brenntag utilized the findings of the Phase II remedial investigation and risk assessments to evaluate potential remedial

action alternatives for the site, which it documented in a feasibility study report. The Department approved the revised feasibility study report, dated Feb. 8, 2017, and will propose one of the remedial alternatives in an upcoming proposed plan following an evaluation of the vapor intrusion (VI) pathway.

In May 2020, Brenntag performed a VI screening evaluation based on groundwater data from four prior sampling events. The Department approved the VI evaluation findings, which recommended VI sampling around the office building on the Cerner property. The Department is awaiting a technical memo of the planned work.

On April 13, 2022 the Department conducted the Fiscal Year 2022 annual inspection and did not observe any new environmental problems.

On May 26, 2022, the Department approved a Soil Gas Sampling Plan submitted by Arcadis, an environmental consultant, on behalf of Brenntag.

General Geologic and Hydrologic Setting:

The HCI Chemtech-Birmingham Road site is located within the 20-year flood plain, just to the north of the Missouri River. The topography is generally level.

About 120 feet of moderately- to highly-permeable alluvium, composed of interbedded sand, gravel, and clay underlies the site. The Pennsylvanian-age Kansas City Group, made up of interbedded shales and limestones with low to moderate permeability, in turn underlies the alluvium.

Surface water infiltration, along with discharge from surrounding bedrock, recharges the alluvial aquifer. In general, the groundwater within the alluvium beneath the site flows toward the Missouri River. Hydraulic gradient and actual groundwater flow direction are dependent upon fluctuating river level.

Public Drinking Water Advisory:

No public water sources are located in the immediate vicinity of the HCI Chemtech – Birmingham Road site. The cities of Independence and Liberty use the Missouri River alluvial aquifer as a primary source of public drinking water, but these wells are located approximately 6 miles east of the site. The nearest surface water intake is approximately 43 river-miles downstream. No impacts to active public water sources are expected.

Health Assessment:

The chemicals of concern at this site include a total of 26 different VOCs, including but not limited to: tetrachloroethene; trichloroethene; 1,2-dichlorobenzene; benzene; 1,4-dichlorobenzene; toluene; ethyl benzene; and xylene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The April 2012 approved Human Health Risk Assessment determined there were no unacceptable risks from any of the current exposure scenarios (i.e., current site worker or current site visitor). Groundwater monitoring continues to detect VOCs above preliminary remediation goals.

The Department identified four private drinking water supply wells within a 4-mile radius of this site. However, these private wells are considered too far removed from the site to be impacted; therefore, no testing has been conducted.

Based on available information, this site does not appear to pose a significant public health risk. However, if site conditions change and allow exposures to contaminated soils or groundwater, adverse health effects may result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

HCI Chemtech - Springfield

Site Name: HCI Chemtech-Springfield

Classification: Class 2

Date of Registry Placement: March 26, 1999

Site Address: 2235 W. Battlefield Road, Springfield, Greene County, MO

Present Property Owner: Brenntag, Inc. Mid-South, Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Volatile and semi-volatile organic compounds including benzene, ethylbenzene, toluene, total xylenes, naphthalene, cis-1,2-dichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, trichloroethylene (TCE), tetrachloroethylene (PCE), and vinyl chloride

Quantity: Not determined

Site Description and Environmental Concern:

The HCI Chemtech-Springfield site is an active chemical distribution facility for prepackaged chemicals. Previous operations at the site included chemical blending, railcar unloading, drum reconditioning, and painting. Past spills of solvents such as tetrachloroethene, trichloroethene, benzene, and xylenes have resulted in soil and groundwater contamination. Chemical handling and distribution activities have occurred at the site since 1975.

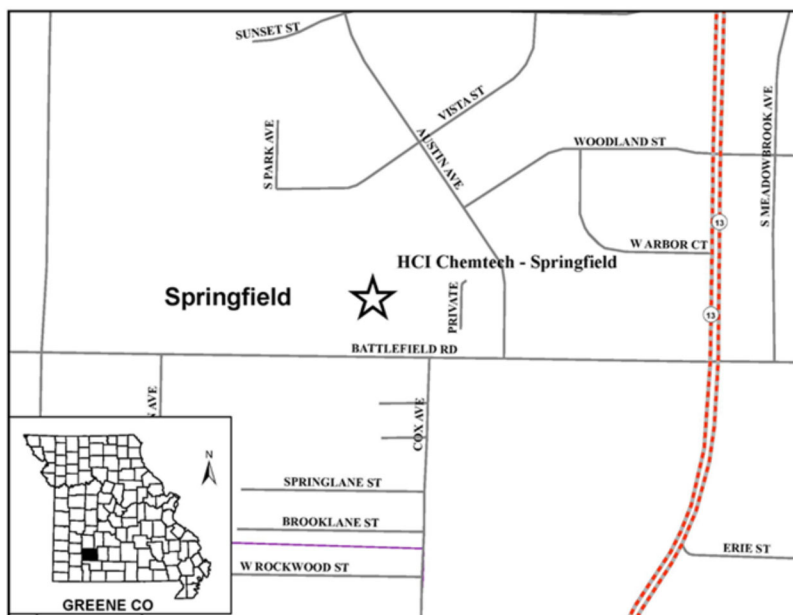
The privately owned facility is approximately 3.75 acres in size and is located in a commercial and light-industrial area. Private residences are located south of the site. On-site structures include an office, warehouse, bag house, drum storage canopy, and a storage shed. The remainder of the site comprises open ground and parking areas. Access to the site's fenced property is restricted to the public.

A 1988 report documented two solvent spills at the site. The first alleged spill occurred in the mid-1970s near the northern property boundary, but the property owners could not confirm the nature of that spill and source of allegation of the spill. The first confirmed spill occurred in 1986 in the former truck loading area and involved approximately 500 gallons.

Groundwater sampling and analysis indicated the presence of contamination down gradient, north of the site. In 2016, the chemical distribution facility's current owner took remedial action to address groundwater contamination north of the site prior to property development. Groundwater sampling conducted in 2020 showed the remedial actions were successful.

Remedial Actions:

In September 1995, the U.S. Department of Justice indicted HCI Chemtech, the site owner, for criminal violations of the Clean Water Act, the Comprehensive Environmental Response, Compensation and Liability Act (CERLA), and the Resource Conservation and Recovery Act (RCRA), due to a release of sodium hydroxide at its Birmingham Road facility in Kansas City. HCI Chemtech pled guilty to one violation of the Clean Water Act, and the U.S. Environmental Protection Agency (EPA) placed them on probation. As a



special condition of this probation, regulatory agencies required HCI Chemtech to adopt corporate and compliance-monitoring programs for each of its Missouri facilities. In 1997, HCI Chemtech, the U.S. Attorney's Office, EPA, and the Missouri Department of Natural Resources (Department) entered into a compliance agreement to investigate the HCI Chemtech sites.

Results from monitoring wells, installed in July 2000, showed contamination in the Springfield Plateau Aquifer. In fall 2000, Brenntag, Inc. (Brenntag) purchased HCI Chemtech. Also in fall 2000, the compliance agreement expired when HCI Chemtech's probation ended. In March 2001, the Department completed an expanded site inspection. In fall 2001, Brenntag signed an Administrative Order on Consent with EPA to perform a remedial investigation and to continue operating the soil-vapor extraction system as an interim remedial action.

The soil-vapor extraction system continues to remove and treat contaminated groundwater and associated soil vapors. The city of Springfield's wastewater treatment system accepts the treated water under authorization of a Department discharge permit. Ongoing groundwater monitoring results show the interim remedial action is improving groundwater quality and maintaining hydraulic control of on-site contaminants. In 2009, in addition to the soil-vapor extraction system, Brenntag installed a sub-slab vapor extraction system to remove vapors from beneath the northern portion of the warehouse building floor. This system operates in a continuous mode. Brenntag monitors the system's efficiency by collecting routine samples.

In April 2016, Brenntag notified the Department that the property owner was in the process of developing the vacant property north of the site. Shallow groundwater contamination existed on this property. The property owner requested removal of all six monitoring wells. The Department requested Brenntag to conduct in-situ chemical oxidation (ISCO) at the property prior to development in order to eliminate and reduce the existing groundwater contaminants.

The Department also approved the removal of the six monitoring wells, contingent upon their replacement after property development was complete. In August 2016, Brenntag completed the ISCO work and monitoring well abandonment. In March 2020, Brenntag installed four replacement wells on the property, subsequent to the development of a grocer warehouse.

On Aug. 9, 2021, Brenntag and the Department signed an Abatement Order on Consent (AOC) for Remedial Design and Remedial Action (RDRA) to implement the remedy as outlined in the Record of Decision (ROD), signed April 28, 2017. Brenntag is preparing additional data to support a requested change to the established remedy, due to technical difficulties related to implementing the remedy at the Springfield Aquifer Well-2 (SAW-2).

On Jan. 4, 2022, the Department approved Brenntag's request to use ISCO as a phased treatment approach in conjunction with excavation to address groundwater and soil treatment.

On June 28, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which inspectors reported no significant changes at the site.

General Geologic and Hydrologic Setting:

The HCI Chemtech-Springfield site is located within the Springfield Plateau portion of the Ozark Plateau physiographic province. It is on a highland between South Creek and an unnamed tributary of Wilson Creek.

The site is in a karst area. Moderately to highly permeable fill composed of gravel, sand, silt, and clay underlie the site to depths of 0.5 to 2.5 feet. Fifteen to 25 feet of tight silty, sandy clay residuum with thin lenses of chert underlie the fill. The residuum is characterized as having low hydraulic conductivity. In turn, Mississippian-age limestone underlie the residuum. The highly weathered limestone is very fractured and permeable in its upper strata, and evidence of karst features abound. Unconsolidated and very fine-grained sediment (predominantly clay and silt) have filled the solution voids encountered at the weathered limestone sub crop. Additional karst features in the immediate vicinity include six known sinkholes within 1 mile of the site, as well as known springs and 24 known caves within a 4-mile radius.

The Mississippian-age limestones beneath the site compose an unconfined aquifer known as the Springfield Plateau Aquifer. The aquifer is about 300 feet thick in this area. The Springfield Plateau Aquifer is recharged

through precipitation infiltration. Shallow groundwater within the aquifer moves to the northwest relative to the contaminant source areas. The Northview Formation, which is about 20 feet thick near the site, is present beneath the Springfield Plateau Aquifer. The Northview Formation is considered to be an aquitard, separating the overlying Springfield Plateau Aquifer from the underlying Ozark Aquifer. Typically, the Northview Formation is relatively impermeable; however, local faults or boreholes may breach the Northview Formation, resulting in potential for vertical contaminant transport into the deeper Ozark Aquifer. Several on- and off-site monitoring wells indicate that no site-related contamination has reached the lower Ozark Aquifer.

Public Drinking Water Advisory:

Contamination from the HCI Chemtech – Springfield site affects the upper Springfield Plateau aquifer, which is characterized by karst conditions such as springs, sinkholes, and rapid infiltration of surface water into the aquifer. The city of Springfield and other public water systems that use groundwater near this site use wells that draw from the deeper Ozark aquifer. Vertical migration of groundwater between the upper and lower aquifers is minimal in this area due to a layer of low-permeability shale. However, fractures in bedrock or boreholes that penetrate both aquifers may locally allow mixing between the two. With continued proper site management, no impacts to active public water sources are expected.

Health Assessment:

Contaminants of concern at this site include, but are not limited to: volatile and semi-volatile organic compounds including: benzene; ethylbenzene; toluene; total xylenes; naphthalene; cis-1,2-dichloroethylene; 1,1-dichloroethane; 1,2-dichloroethane; TCE; PCE; and vinyl chloride.

Various volatile organic compounds (VOCs) contaminate the soil, groundwater, sub-slab soil gas, and soil gas. VOCs also impact shallow groundwater off site. In particular, groundwater contaminants found above the public drinking water standards include, but are not limited to: 1,1-DCA; cis-1,2-dichloroethylene; TCE; PCE; toluene; benzene; vinyl chloride; and xylene. A Human Health Risk Assessment, approved in 2011, documented risk to human health if site contamination is not addressed adequately. A previous investigation by the Missouri Department of Health and Senior Services did not identify any private wells that were in use around the facility.

Due to detections of contaminants in soil, soil gas, sub-slab soil gas, groundwater in the close proximity of homes, and the off-site migration of VOC-contaminated groundwater, a public health risk exists at this site.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, or call 573-751-6102.

HCI Chemtech - St. Louis

Site Name: HCI Chemtech - St. Louis

Classification: Class 2

Date of Registry Placement: December 28, 1998

Site Address: 139 E. Soper St., St. Louis, St. Louis County, MO

Present Property Owner: Brenntag, Inc.
Mid-South, Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals

Quantity: Not determined

Site Description and Environmental Concern:

The HCI Chemtech - St. Louis site is an active chemical formulation and distribution facility that has operated since 1967. Trucks, barges, and railcars deliver bulk chemicals, which are stored in aboveground storage tanks. Past spills of hazardous materials such as tetrachloroethene, trichloroethene, benzene, xylenes, and metals have contaminated soils and groundwater. Chemical handling and distribution have occurred at the site since 1979.

The privately owned facility occupies 15 acres in an industrial area on the Mississippi River's west bank and within the Mississippi River flood plain. Private residences are located about 1,000 feet west of the site. On-site structures include an office, a warehouse, and tank farms containing 76 aboveground storage tanks. Access to the site's fenced property is restricted to the public.

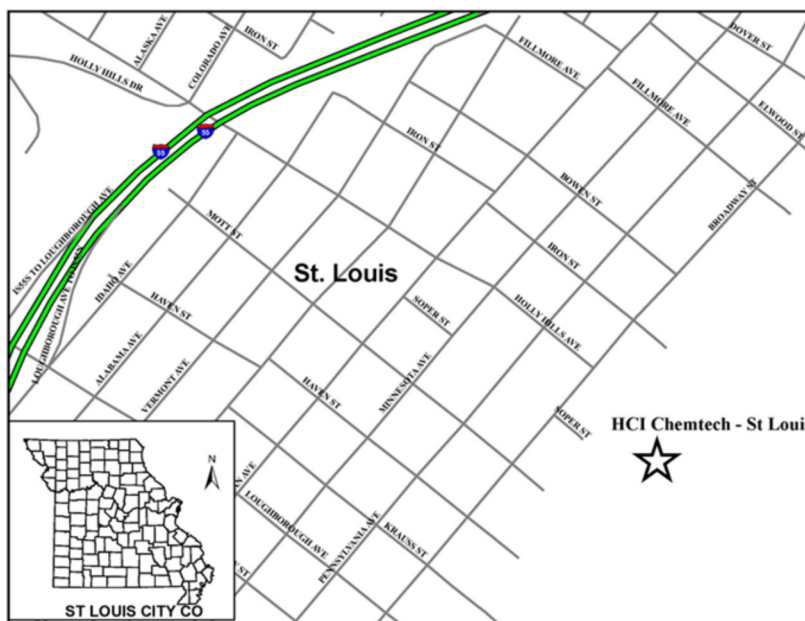
Total benzene, toluene, ethylene, xylene, and chlorinated volatile organic compounds (VOC) originating in the central portion of the site commingled and appear to be migrating in shallow groundwater toward the Mississippi River and onto the northern adjacent property, the abandoned U.S. Coast Guard Old Base.

Remedial Actions:

During Fiscal Year 1999, the U.S. Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources (Department) reviewed and commented on plans and reports submitted by HCI Chemtech pursuant to the Compliance Agreement. During 2000, EPA and the Department approved HCI Chemtech's Remedial Investigation Work Plan that included the installation of additional monitoring wells, along with hydrogeological investigations.

In fall 2000, Brenntag Inc. purchased HCI Chemtech. Also in fall 2000, the compliance agreement expired when HCI Chemtech's probation for criminal violations at its Birmingham Road facility ended. No additional characterization or remedial action occurred; however, groundwater monitoring continued.

On March 15, 2011, the Department and Brenntag signed an Abatement Order on Consent for the St. Louis site.



In March 2016, as part of additional site-related work, the Department approved a Vapor Intrusion Work Plan, beginning with a vapor intrusion (VI) study. This study consists of sampling multiple locations for indoor air and sub-slab vapor intrusion to account for seasonal variance such as temperature and rainfall. Brenntag's contractor completed the VI study in October 2019. Subsequent mitigation efforts to improve indoor air quality included improvements to the site building's heating, ventilation, and air conditioning (HVAC) systems. Improvements to the plumbing and sewer system sealed off potential preferential pathways from the subsurface to indoor air. Improvements to the HVAC system increased air turnover rates and increased the differential pressure within the office space to reduce the potential for VI. During these improvements to the HVAC system, an additional unit was added to the building to further increase heating, cooling, and air turnover capacity.

To evaluate the effectiveness of the implemented mitigation actions, Arcadis collected confirmation indoor air and sub-slab soil vapor samples in January and August 2019. Arcadis summarized the investigation activities and results in several 2019 reports.

The two rounds of confirmation indoor air sampling determined that the mitigation measures have improved indoor air quality at the site building's southern end and the VI pathway currently is not complete at concentrations exceeding the applicable health protective levels.

On May 7, 2020, Brenntag contractor submitted a final Vapor Intrusion Mitigation Operation and Maintenance Plan. On Feb. 28, 2022, Brenntag's contractor submitted an Annual Vapor Intrusion Mitigation Operation and Maintenance Report stating that the VI mitigation measures were working as intended.

On May 3, 2022, the Department conducted the Fiscal Year 2022 annual inspection during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The HCI Chemtech - St. Louis site is underlain by 18 to 35 feet of moderately to highly permeable fill material composed of sand, silt, slag, and rubble. Underlain by 5 to 20 feet of moderately to highly permeable alluvial sediments, the fill is composed of clayey silts and sands. The alluvial sediments, in turn, are underlain by the moderately permeable Mississippian-age St. Louis Limestone. The depth to bedrock beneath the site is about 40 feet, with depth increasing toward the Mississippi River. Shallow groundwater can recharge beneath the site through infiltration of precipitation and through discharge from surrounding bedrock. The direction of groundwater flow is generally to the east toward the Mississippi River; however, the hydraulic gradient and actual groundwater flow's direction depend upon fluctuating river levels.

Since the site is located in a groundwater-discharge setting, contaminants from the site may not affect the underlying bedrock. However, significant potential exists for site contaminants to discharge to the Mississippi River.

Health Assessment:

Toluene, arsenic, and several other polycyclic aromatic hydrocarbons, including benzo(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene and indeno(1,2,3-cd)pyrene, have been detected in the soil at concentrations exceeding health-based screening levels. These chemicals, along with benzene, toluene, xylene, and chlorinated VOCs, are present in the groundwater under the site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Groundwater migration off site, onto the U.S. Coast Guard property, may pose a health risk to indoor workers. Risk associated with the groundwater-to-indoor-air pathway has been eliminated due to mitigation efforts. As long as areas of mitigation are monitored and prove to remain effective, the VI pathway is not a health concern. Hazardous waste substances have the potential to be released during flooding and/or rising groundwater levels. Based on available information, this site poses a potential health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

HCI Chemtech - Stillwell St.

Site Name: HCI Chemtech - Stillwell Street

Classification: Class 2

Date of Registry Placement: August 21, 1999

Site Address: 5200 Stillwell Street,
Kansas City, Jackson County, Mo.

Present Property Owner: Brenntag Mid-South, Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)

Quantity: Not determined

Site Description and Environmental Concern:

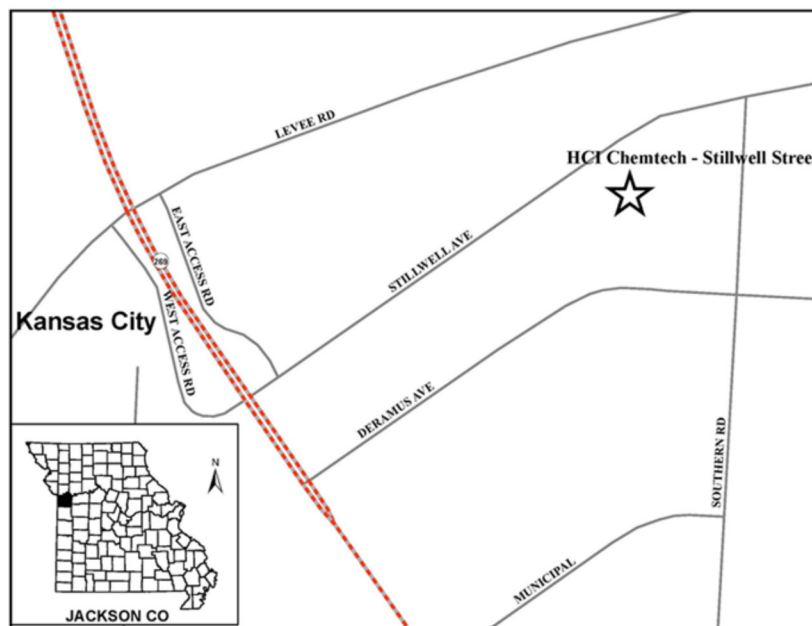
The HCI Chemtech – Stillwell Street site is an active bulk chemical storage and distribution facility. Trucks and railcars deliver bulk chemicals, which are stored in aboveground storage tanks. Past spills of solvents such as tetrachloroethene, trichloroethene, benzene, and xylenes have resulted in soil and groundwater contamination. Chemical handling and distribution have occurred at the site since 1981.

The privately owned facility occupies 6.5 acres along the southern bank of the Missouri River levee in a mixed commercial and industrial area, which lies within the Missouri River flood plain. Private residences are located approximately 0.5 mile from the site. Current on-site structures include an office, warehouse, and tank farms that contained approximately 50 aboveground storage tanks. Access to the site's fenced property is restricted to the public.

Groundwater sampling and analysis indicated the presence of up-gradient contamination. In 1991, RMT, Inc., a consultant for Ashland Chemicals, a former site owner and operator, detected volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) in groundwater at concentrations above health-based screening levels. In April 1992, RMT Inc. conducted a Phase II investigation, which concluded groundwater contaminants originating on the HCI Chemtech - Stillwell Street property were migrating off site to the north beneath the Riverfront Landfill. The groundwater plume has since contracted to the center of the property near the source areas, due to the implementation of the Soil Vapor Extraction system. Due to the success of the Soil Vapor Extraction system, implemented in 2007, VOC concentrations have decreased significantly in the groundwater.

Remedial Actions:

In September 1995, the U.S. Department of Justice indicted HCI Chemtech, the site owner, for criminal violations of the Clean Water Act, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the Resource Conservation and Recovery Act (RCRA), due to a release of sodium hydroxide at its Birmingham Road facility. HCI Chemtech pled guilty to one violation of the Clean Water Act, and EPA placed them on probation. As a special condition of this probation, regulatory agencies required HCI Chemtech to adopt corporate and compliance monitoring programs for each of its Missouri facilities. In 1997, HCI Chemtech, the U.S. Attorney's Office, the U.S. Environmental Protection Agency (EPA), and the



Missouri Department of Natural Resources (Department) entered into a compliance agreement to investigate the HCI Chemtech sites.

In June 2000, HCI Chemtech submitted a remedial investigation work plan. In fall 2000, Brenntag Mid-South, Inc. (Brenntag), purchased HCI Chemtech. Since 2001, Brenntag has performed groundwater monitoring at the site on a semi-annual schedule. Pursuant to a 2005 Administrative Order on Consent (AOC) between EPA and Brenntag, Brenntag conducted a remedial investigation and feasibility study to determine the extent of the release of hazardous substances at or from the site, and to develop and evaluate options for remedial action. In 2008, EPA approved the Remedial Investigation Report and the Human Health Risk Assessment and in 2011, EPA approved the feasibility study. EPA then transferred future management of the site to the Department.

On May 16, 2007, EPA approved a soil vapor extraction (SVE) pilot test and an SVE design report. The pilot test indicated that the source area (soil) contaminated with VOCs could be addressed immediately and additional actions could be implemented if needed. Based upon the successes of the SVE pilot test, Brenntag installed a full-scale SVE system as an additional response action to treat soil in the source areas in 2008.

The SVE system operated for more than eight years. Based on the past removal rates found in the quarterly progress reports, the SVE system successfully addressed the unsaturated VOC-impacted soils. The estimated total VOC mass removed since the SVE system's startup through Feb. 10, 2017, was approximately 3,087.6 pounds. Therefore, Brenntag recommended and the Department approved deactivating the SVE system and beginning a period of monitored natural attenuation to assess the remedial alternative's performance.

The Department prepared a proposed plan for the site to present the Department's preferred alternative to address chemicals of concern in the soil and groundwater at the site and to solicit the affected community's views. The Department's preferred option is to use monitored natural attenuation for treatment of contaminated groundwater and to turn the SVE system back on if VOC concentrations increase. The Department did not receive any public comments. The Department is preparing the Record of Decision, which will document the final decision regarding the selected remedies in the near future.

At the Department's request, on June 11, 2020, Brenntag submitted a Vapor Intrusion Evaluation report. Brenntag based the screening evaluation on the previous two years of groundwater monitoring data (collected in October 2018, April 2019, November 2019, and April 2020), and exterior soil gas sampling (conducted in March 2008), prior to initiating interim SVE remediation measures.

Ethylbenzene is the only site contaminant detected in groundwater at concentrations exceeding the commercial vapor intrusion screening level. In March 2008, exterior soil gas samples did not detect ethylbenzene above the EPA commercial soil gas screening level in any of the exterior soil gas samples. Based on the reduction of soil and groundwater concentrations over time, in conjunction with interim remediation, Brenntag concluded that soil gas concentrations likely have reduced as well. Brenntag did not recommend additional vapor intrusion evaluation. On July 28, 2020, the Department, in consultation with the Missouri Department of Health and Senior Services (DHSS), concurred with Brenntag's evaluation, as long Brenntag places an Environmental Covenant on the property, as stated in the Vapor Intrusion Screening Evaluation.

On April 13, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The HCI Chemtech - Stillwell Street site is located within the 20-year flood plain along the Missouri River's south bank. The topography is generally level.

About 120 feet of moderately to highly permeable alluvium composed of interbedded sand, gravel, and clay underlies the site. The alluvium is underlain by the Pennsylvanian-age Kansas City Group, which is composed of interbedded limestones and shales with low to moderate permeability. The alluvial aquifer receives recharge through surface water infiltration, as well as through discharge from the surrounding

Pennsylvanian-age bedrock. In general, groundwater within the alluvium flows toward the Missouri River, with hydraulic gradient and actual groundwater flow direction dependent upon fluctuating river levels. Site contaminants could potentially discharge to the Missouri River.

Public Drinking Water Advisory:

The cities of Independence and Liberty have well fields approximately 8 miles downstream, and the nearest surface water intake is approximately 45 river-miles downstream. No impacts are expected.

Health Assessment:

The following are the major contaminants of concern: VOCs and SVOCs. Concentrations of benzene, toluene, ethylbenzene, and xylene in groundwater exceeded EPA's drinking water standards, the maximum contaminant level. Other substances found include dichloromethane, vinyl chloride, 1,1-dichloromethane, and acetone. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

A 2020 vapor intrusion investigation concluded that VOCs in both groundwater and soil have decreased over time. With decreased source contamination, it is likely that the soil gas concentrations likely have also decreased. The Department and DHSS agreed that no further vapor intrusion investigation is necessary. Based on available information, this site does not appear to pose a significant public health risk. DHSS encourages an environmental covenant be established, as stated in the Vapor Intrusion Screening Evaluation.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Solid State Circuits

Site Name: Solid State Circuits (SSC)

Classification: Class 2

Date of Registry Placement: February 22, 1985

Date of National Priorities List Listing: June 10, 1986

Site Address: Southeast corner of the intersection of Elm St. and Main St., Republic, Greene County, Mo., Brookline Quadrangle

Present Property Owner: M&M Electric Builders, c/o Michael and Melia Cleveland

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Trichloroethene (TCE)

Quantity: Not determined

Site Description:

The Solid State Circuits (SSC) site is where the SSC company operated a printed circuit board manufacturing facility that used the solvent trichloroethene (TCE) to clean parts. Because of past storage and handling practices, SSC released TCE to soil and groundwater near the former facility.

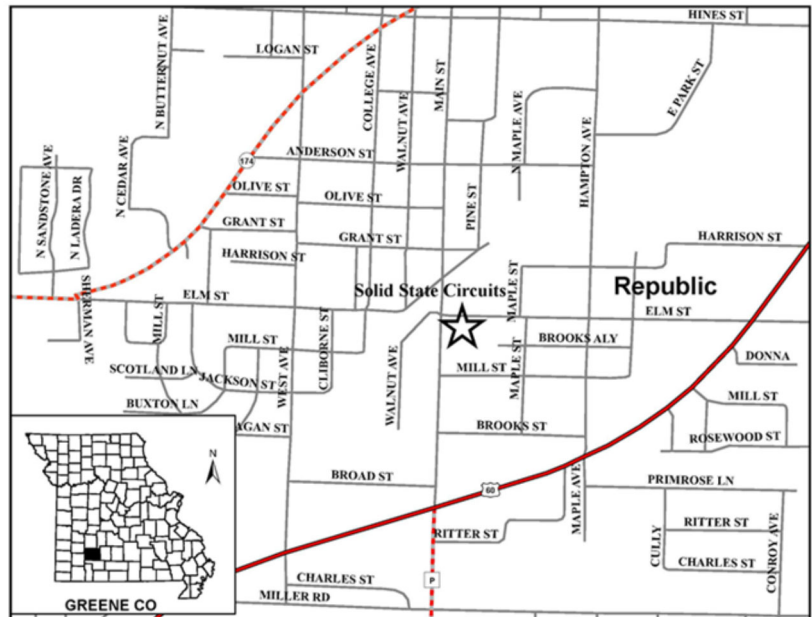
The former SSC facility is located on a privately owned 0.76-acre parcel in a mixed commercial/residential setting just south of downtown Republic. Private residences are located east and south of the site. The only structure remaining at the site is a temporary maintenance outbuilding associated with the site's treatment and monitoring program. The ground surface is vegetated, and a locked fence surrounds the parcel.

The SSC facility operated between 1968 and 1973 in the northern portion of an early 20th century four-story grain mill, which was later demolished following a fire in 1979. TCE was stored in the building's basement where a bedrock production well also was located. Release of an unknown mass of TCE during SSC's operation resulted in soil and groundwater contamination beneath the building.

As part of a 1984 nationwide municipal well study, the Missouri Department of Natural Resources (Department) identified TCE in one of the city of Republic's municipal drinking water wells, located approximately 600 feet south of the site. A subsequent investigation attributed the TCE to releases at the former SSC facility. The city of Republic immediately abandoned the affected public well and found no TCE detections in any of the other municipal wells. The extent of TCE migration in the bedrock aquifer is under assessment. TCE also migrated in the shallow subsurface along the utility corridor that runs north to south along Main Street, and this migration also is under investigation. Environmental concerns at the site include TCE migration in the bedrock aquifer toward municipal wells to the east, and intrusion of TCE vapors into occupied buildings located near the utility corridor.

Remedial Actions:

After the U.S. Environmental Protection Agency (EPA) identified and confirmed the TCE contamination source, the agency completed a number of removal actions. EPA excavated more than 2,000 cubic yards of



contaminated material from inside the basement foundation and disposed of the contaminated materials at a permitted disposal facility. To prevent the further spread of contaminants, EPA plugged the production well, which served as a conduit for contaminant migration.

EPA placed the site on the National Priorities List June 10, 1986. In summer 1989, SSC completed the Remedial Investigation/Feasibility Study. The remedial investigation identified TCE contamination in the groundwater in each of the three underlying hydrologic systems.

On Sept. 27, 1989, EPA signed the Record of Decision which included: (1) extraction of TCE-contaminated groundwater using existing and new wells; (2) on-site treatment of the extracted groundwater using air strippers; (3) discharge of treated water to Republic's sewer system to receive further treatment at the publicly-owned treatment works; (4) a municipal ordinance to prevent construction of drinking water wells in or near the contaminated groundwater plumes; and, (5) continued monitoring to determine the remedy's effectiveness. In July 1990, the agencies and the Missouri Remedial Action Corporation (MRAC) signed the Consent Decree/Statement of Work for the Remedial Design/Remedial Action. The parties entered the agreement with the court May 31, 1991.

In 1993, MRAC constructed the pump-and-treat system, which extracts groundwater from each of the three hydrogeologic systems and treats the water using air strippers. In May 1994, EPA and the Department determined the remedy was operational, functional, and performing as designed. The estimated time to remediate the SSC site is 20 to 40 years.

From 2003 to 2011, MRAC conducted full-time clean water injections through a horizontal well to assist in remediating TCE contamination in the Unconsolidated/Fractured Shallow Bedrock aquifer. In 2011, a fire destroyed the groundwater pump-and-treat operational facility. As a result, on June 15, 2012, the agencies and MRAC signed a Force Majeure/Excusable Delay Agreement. During its operation, the horizontal well treated and discharged more than 13 million gallons of groundwater.

The Force Majeure/Excusable Delay Agreement serves as a guide to conduct future site activities. The agreement outlines the following remedial actions: soil remediation under the pilot programs; continued groundwater/surface water and soil sampling/monitoring; completion of a focused feasibility study; and, a projected schedule of events. The focused feasibility study will develop an updated site conceptual model, an updated Human Health Risk Assessment, an updated Screening Level Ecological Risk Assessment, and an evaluation of future remedial action alternatives for the SSC site.

MRAC identified and treated three soil-contamination source areas during the Supplemental Site Investigation in 2012 and 2015. MRAC re-installed on-site wells in 2013, conducted geophysics assessments on three wells in 2014, and reconfigured the assessed wells in 2015. In 2020, MRAC injected reagents into site soils to degrade contaminants. MRAC continues to evaluate the results through verification groundwater sampling.

Ongoing groundwater/surface water monitoring/sampling allows the agencies to evaluate the effects of the pumping cessation, as well as the effects of pilot program remediation efforts for on-site and off-site groundwater.

MRAC continues to investigate and address potential vapor intrusion risks posed by the site. In July 2019, MRAC installed a sub-slab depressurization system at a residential property. MRAC conducted additional indoor air sampling at the property in August 2019, February 2020, and May 2020, followed by preliminary sanitary sewer air and water sampling in June 2020. In November 2020, MRAC repaired compromised sewer pipe connections, which stopped vapor intrusion into the residence. In March 2022, MRAC sampled the indoor air of several properties near the site. MRAC plans additional vapor intrusion sampling during fall 2022.

On Sept. 19, 2017, the Department and EPA completed and signed the fifth Five-Year Review report. The agencies were unable to make a protectiveness determination since ongoing pilot study activities continued past the fifth Five-Year Review deadline. Under the Force Majeure/Excusable Delay Agreement, the agencies will resolve the protectiveness determination once MRAC completes the ongoing pilot study and obtains further data and information. The Department and EPA completed the site's sixth Five-Year Review in December 2021. The Department and EPA will sign the Five-Year Review in fall 2022.

On June 28, 2022, the Department conducted the Fiscal Year 2022 annual site inspection, during which inspectors reported no significant changes at the site.

General Geologic and Hydrologic Setting:

The SSC site is located in a broad, upland setting with regional karst development. Small spring and cave systems exist in and around Republic. Rocks of Mississippian and Ordovician age underlie most of the region. The subsurface geologic units have been divided into three hydrogeologic layers: the Unconsolidated/Fractured Shallow Bedrock System, the Shallow Bedrock Aquifer, and the Deep Bedrock Aquifer.

The Unconsolidated/Fractured Shallow Bedrock System includes 10 to 20 feet of stony, red clay residuum, and about 75 feet of Mississippian-age Burlington-Keokuk Limestone, consisting of weathered, fractured, and cherty limestone. This zone is moderately to highly permeable, with fractures that have provided avenues of rapid fluid transport to groundwater. Regional groundwater flow of the Unconsolidated/Fractured Shallow Bedrock System is south-southeast toward the Schuyler Creek drainage system. Perched water is likely present at the soil-bedrock contact.

The Shallow Bedrock Aquifer includes the lower, unfractured Mississippian-age Burlington-Keokuk Limestone, which ranges from about 75 feet to 300 feet below the surface. Regional groundwater flow in the Shallow Bedrock Aquifer is toward the southeast.

The Deep Bedrock Aquifer includes deep, Ordovician-age dolomite and sandstone bedrock below a confining unit, which is more than 300 feet deep.

TCE contamination from the SSC sites impacted all three hydrogeological systems. Primary routes of contaminant migration are along fractures in the shallow aquifer. TCE also migrated down an abandoned well that penetrated the confining layer and contaminated the deeper aquifer.

Public Water Drinking Water Advisory:

The city of Republic uses four deep wells that draw from the deeper Ozark Aquifer. The closest well to this site is approx. 0.9 mile east of the site, and the second closest well is approximately 1.2 miles to the west. Both of these wells are cased to at least 450 feet deep. The other two system wells are several miles from the site. Although TCE contamination affected both the shallow and deep aquifers in this region, it is unlikely that the city of Republic's public water source is at risk.

Health Assessment:

The contaminant of concern at this site is TCE. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The exposure route of greatest concern is ingestion of contaminated groundwater, although private well sampling indicates that this is not occurring. Between 2002 and 2017, the Missouri Department of Health and Senior Services (DHSS) collected samples from private wells at the southern and southeastern edges of town and did not detect TCE or its breakdown products.

Due to the proximity of city residences to the site, along with the previous contamination of the city's drinking water supply, a potential health threat exists. Although DHSS' private well testing has not detected TCE, with the pump-and-treatment system not functioning, groundwater monitoring should continue.

Vapor intrusion remains a potential concern and is under further investigation.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, or call 573-751-6102.

Thompson Chemical/Superior Solvents

Site Name: Thompson Chemical/Superior Solvents

Classification: Class 2

Date of Registry Placement: September 23, 1986

Site Address: 60 Chouteau Ave., St. Louis, St. Louis City, MO

Present Property Owners: Superior Solvent and Chemicals, a subsidiary of Superior Oil Company of Indianapolis, Ind.

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), and semi-volatile organic compounds (SVOCs)

Quantity: Not determined

Site Description:

The Thompson Chemical/Superior Solvents site is the property that the Thompson Chemical Company used for production of Agent Orange from about 1950 to 1968. Wood Treating Chemicals Company operated at the property to formulate pentachlorophenol (PCP) from 1963 to 1974. Because of historic manufacturing practices, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin), a waste byproduct from the production of Agent Orange; volatile organic compounds (VOCs); and polycyclic aromatic hydrocarbons (PAHs) are present in the surface and subsurface soils.

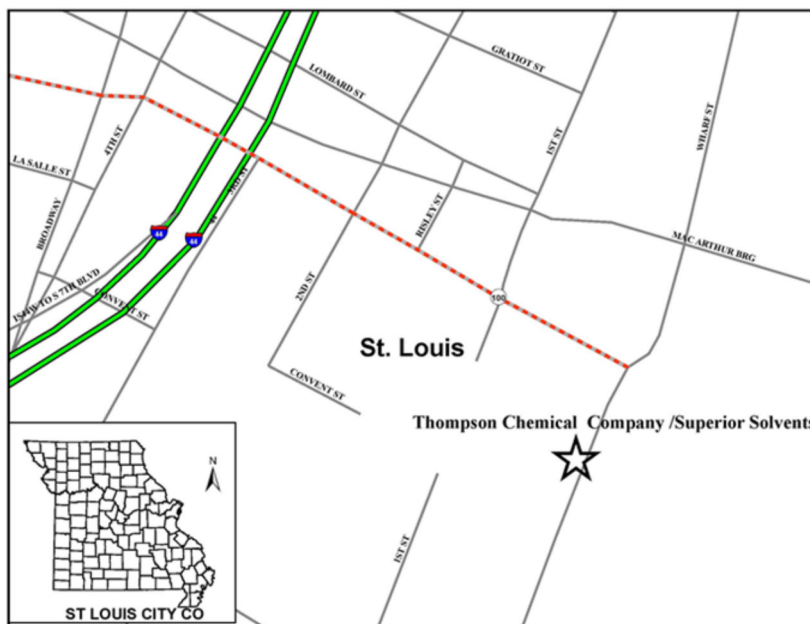
This privately-owned property is located near the west bank of the Mississippi River in a historically industrial area of the city of St. Louis. Thompson Chemical Company changed its name to Superior Solvents and Chemicals in 1974, and it operated as an active solvent distribution business at the site until the company moved to a new facility in May 2014. The site is a 3-acre vacant lot with one building, surrounded and secured by a fence with a locked gate.

In 2013, the potentially responsible parties (PRP) removed on-site roll-off boxes and drums containing waste and excavated contaminated on-site berm soils. TCDD, VOCs, SVOCs, and PAHs remain in soils and groundwater at the site.

Off-site exposure of pedestrians and on- and off-site exposure of industrial workers to surface and subsurface contamination is possible. In addition, exposure to contaminants due to the site's proximity to the river may affect the Mississippi River ecosystem.

Remedial Actions:

In 1984, the U.S. Environmental Protection Agency (EPA) completed a Preliminary Assessment and a Site Investigation. Sampling confirmed the presence of contaminants in soil and located a leaking underground storage tank. TCDD contamination in soils ranged from 1 part per billion (ppb) to 160 ppb.



In 1987, EPA conducted additional sampling and found contamination seeps in the Mill Creek Trunkline Sewer. Also in 1987, the responsible party excavated the underground storage tank and surrounding soils. The contaminated soils were stored on site in 13 roll-off boxes.

In July 2013, the PRP and EPA approved and signed the Administrative Settlement Agreement and Order on Consent to implement the remedial action: properly dispose of the 12 on-site roll-off boxes and 255 55-gallon drums, excavate contaminated on-site berm soils, and properly dispose of them. Following removal activities, the PRPs restored the berm area to grade and leveled with gravel and covered with asphalt. The responsible parties completed the remedial action fieldwork in November 2013. On Feb. 28, 2014, EPA approved the final remedial action report.

Superior Solvents and Chemicals purchased property in Arnold, Missouri, in 2013. The company constructed a new facility and completed its move to the new Arnold facility by May 2014.

In March 2018 and September 2019, the Missouri Department of Natural Resources (Department) discussed with EPA the site's status and a potential path forward, including issues to be addressed from a Resource Conservation and Recovery Act perspective.

TCDD, VOCs, SVOCs, and PAHs remain in soils and groundwater at the site. Therefore, in 2019, EPA began negotiations with the PRP to address work not completed during the previous (2013) settlement agreement. This additional work includes conducting groundwater sampling, additional soil sampling, soil removal work, and establishing an environmental covenant on the site. On Sept. 30, 2020, EPA signed the Thompson Chemical Administrative Settlement Agreement and Order on Consent for removal action. The PRP is currently in the assessment phase and conducting a risk assessment. In April 2022, the PRP detected dioxin in soils along the road shoulders. EPA requested they halt their assessment and address that immediate threat. After removing those contaminated soils, the PRP will continue with their risk assessment. The PRP will send EPA a final report for dioxin removal after they complete the risk assessment.

On May 3, 2022, the Department conducted the Fiscal Year 2022 annual registry inspection. The inspection noted there is vegetation growing through the cracks and seams of the cap, with small- to moderate-size woody vegetation growing throughout the property. Trespassing on the property was evident by graffiti painted on buildings and some trash found on the site. At least two homeless people appeared to be staying on site in the drum storage warehouse. The fence has a locked gate, but there are holes in the fencing.

General Geologic and Hydrologic Setting:

This site is approximately 300 feet west of the Mississippi River. This area is an alluvial remnant of the Mississippi River, altered by man-made fill material. Man-made levees to the east provide partial protection from floodwaters. Surface drainage and storm sewers flow to the east and enter the Mississippi River within 400 feet. Numerous sinkholes exist west of the site where the Mississippian-age bedrock lies close to the surface.

The subsurface soils consist of an upper zone of man-made fill and debris from the existing ground surface to a depth of 18 to 23 feet. The extremely heterogeneous fill is composed of dirt, cinders, brick, scrap concrete, and other debris. Permeability in this unconsolidated zone is likely to be relatively high.

Approximately 35 feet of alluvial clay, silt, and sand underlie the fill material. Fine- to medium-grained alluvial sand, with some gravel, cobbles, and clay seams, underlie the upper cyclic strata of silts and clays between 10 to 15 feet thick. The sand stratum, which varies in thickness from about 10 to 20 feet, appears to slope eastward toward the Mississippi River and likely is exposed in the riverbed. Permeability of the sand varies considerably; consequently, a corresponding variation occurs in the rate of groundwater flow in the alluvium.

The St. Louis Limestone underlies the unconsolidated material on site at an approximate depth of 50 feet below the surface. Karst features have developed in this unit to the west of the alluvial area.

Most water movement is to the east, toward the Mississippi River, via surface drainage or through permeable alluvium. The potential for infiltration into shallow alluvial groundwater supplies is high. The risk to bedrock groundwater supplies is reduced since the site is located in a discharge environment. However, dense

non-aqueous phase contaminants in high concentrations could affect the groundwater supplies in the shallow bedrock.

Public Drinking Water Advisory:

The city of St. Louis draws source water from the Missouri and Mississippi rivers, but all active intakes are upstream from this site. Illinois American Water – East St. Louis has one surface intake approximately 2 miles upstream. The city of Chester, Illinois, and the Menard Correction Center Department (Chester, Ill) have surface water intakes approximately 68 river-miles downstream from this site. No impacts to any public water sources are expected.

Health Assessment:

The chemicals of concern at this site include PAHs, VOCs, TCDD, and SVOCs. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Contaminants could possibly reach the river, either through the groundwater or through the sewer system. Although now remediated, the site once contaminated the adjacent Mill Creek sewer. The Department of Health and Senior Services is not aware of any groundwater use for drinking purposes in this area.

Based on available information, the site poses a potential health risk due to the noted vegetation growing through seams present in the cap, on-site trespassing, and the potential for contamination of the Mississippi River.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

West Lake Landfill

Site Name: West Lake Landfill

Classification: Class 2

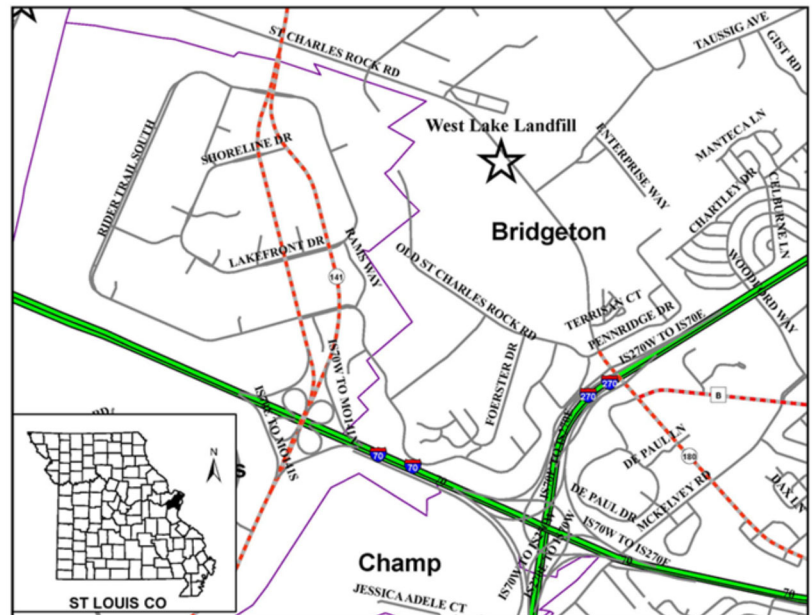
Date of Registry Placement: February 22, 1985

Date of NPL Listing: August 30, 1990

Site Address: 13570 St. Charles Rock Road, Bridgeton, St. Louis County, Mo., between Old St. Charles Rock Road and St. Charles Rock Road east of Earth City, T46N, R5E, St. Charles Quadrangle

Present Property Owner: Rock Road Industries, Inc.

Lead Agency: U.S. Environmental Protection Agency (EPA)



Waste Type: Radionuclides, industrial wastes, and municipal wastes

Quantity: Approximately 8,700 tons of uranium ore-processing residue waste were the primary source of radionuclides for Operable Unit (OU) 1. Transporters hauled the waste, mixed with approximately 39,000 tons of soil from the Hazelwood Site, to the West Lake Landfill for use in solid waste landfill operations. The volume of waste for OU-2 is unknown.

Site Description and Environmental Problems:

The West Lake Landfill site is a former quarry and waste disposal site containing various waste and radiological contamination. The U.S. Environmental Protection Agency (EPA) divided the site into three operable units based on the type of contamination present in each unit. Operable Unit 1 (OU-1) includes areas known to contain radiologically impacted material (RIM), which the landfill received in 1973. Operable Unit 2 (OU-2) consists of several former solid waste disposal areas identified as the former active sanitary landfill, also known as Bridgeton Sanitary Landfill, a closed demolition landfill, and an inactive sanitary landfill. The pre-law portions of these landfills operated and closed before implementation of federal and state regulations. Operable Unit 3 (OU-3) addresses groundwater impacted by wastes disposed of at the site within the alluvium and bedrock deposits beneath the site.

The privately owned landfill is approximately 212 acres in size and is located in a mixed commercial and manufacturing setting, with residential properties to the south and east. The site property also includes an active waste transfer station, a leachate pre-treatment facility, and an asphalt plant that are not part of the Superfund site. The site lies partially within the Missouri River geomorphic flood plain in northwest St. Louis County, where an engineered levee system protects it from flooding.

In 1973, the West Lake Landfill received radiological contamination from the Hazelwood Interim Storage Site and was used for landfilling operations. Records indicate that Cotter Corporation directed the transport of about 8,700 tons of leached barium sulfate, which contained about 7 tons of uranium, mixed with about 39,000 tons of surface soil.

Overall, contamination at the site includes organic, inorganic, and radiological chemicals of concern that may release into leachate, landfill gas, and groundwater. Groundwater sampling indicates concentrations above the maximum contaminant level (MCL) for certain radionuclides, trace metals, and volatile organic compounds (VOCs).

Based on available studies, a potential health threat exists to on-site users from exposure to external gamma radiation and radon gas emissions. More information is included under the Health Assessment section.

Remedial Actions:

On Aug. 30, 1990, EPA placed the site on the National Priorities List, mandating that EPA conduct response actions.

In March 1993, the Responsible Parties (RPs) and EPA negotiated an Administrative Order on Consent (AOC) to conduct a Remedial Investigation/Feasibility Study (RI/FS) of the radiologically-contaminated portions of the landfill (OU-1). The responding RPs include: Cotter Corporation; Republic Services, Inc.; Bridgeton Landfill, LLC; Rock Road Industries, Inc.; and the U.S. Department of Energy. In May 2019, EPA amended the order to incorporate remedial design work after the Record of Decision (ROD).

In December 1994, Bridgeton Landfill, LLC and EPA negotiated a separate AOC to determine how to address the non-radiological waste portions of the landfill (OU-2, including Bridgeton Sanitary Landfill). In July 2008, Bridgeton Landfill, LLC and EPA signed the OU-2 ROD and the remedial design is being coordinated with OU-1.

Cotter Corporation, Republic Services, Inc., and the U.S. Department of Energy are potentially responsible parties for OU-3. In September 2018, they negotiated a third AOC with EPA to investigate and address site-wide groundwater contamination.

OU-1 Actions:

On May 29, 2008, EPA finalized the ROD for OU-1. In September 2018, EPA amended the ROD based on subsequent studies and investigations. Additional work in fate-and-transport testing during this time also prompted EPA to create OU-3 for site-wide groundwater.

On Dec. 9, 2015, EPA and the RPs entered into a unilateral administrative order for fire prevention measures in response to a small brush fire. Activity included de-vegetation and placement of non-combustible cover over portions of Area 1, Area 2, and the Buffer Zone where RIM is at or near the surface. Implementation of a site-wide Incident Management Plan was included in the order. In 2016, the RP installed a non-combustible cover over those portions of Areas 1 and 2 where RIM is present at or near the ground surface. In addition to reducing the potential for a surface fire, the cover may reduce the potential for exposure due to migration of dust and direct contact with soils.

In February 2018, EPA announced a plan to amend the 2008 OU-1 ROD. EPA concluded the presumptive remedy chosen in 2008 is no longer acceptable based on additional data, and EPA followed up with an amended remedy in September 2018. The amendment fundamentally changes the 2008 ROD Selected Remedy for OU-1 by requiring partial excavation of RIM that contains combined radium or combined thorium activities greater than 52.9 pCi/g and is located generally within 12 feet of the 2005 topographic surface. Excavated material must be transported off-site to a licensed disposal facility. The required landfill cover over OU-1 must now meet the municipal waste landfill regulations, the Uranium Mill Tailings Radiation Control Act's (UMTRCA) performance and longevity standards, and consider Resource Conservation and Recovery Act (RCRA) hazardous waste design criteria.

OU-2 Actions:

On July 25, 2008, EPA signed the ROD for OU-2. EPA based the ROD Selected Remedy for OU-2 on the presumptive remedy for municipal waste landfills that pose a relatively low long-term threat or where treatment is impracticable. After the respondent performed a streamlined site evaluation, EPA selected containment in place as the remedy for the Inactive Sanitary Landfill. It would include an engineered landfill cover system, long-term monitoring, maintenance, institutional controls, inspections, and periodic reviews. EPA deferred the Closed Demolition Landfill and the Former Active (Bridgeton) Sanitary Landfill to state regulation.

Bridgeton and Closed Demolition Landfill

In December 2010, Bridgeton Landfill, LLC reported elevated temperatures from an apparent thermal reaction in the Former Active Sanitary Landfill. This landfill area consists of two former sanitary landfill units: the North Quarry and the South Quarry. The thermal reaction began in the South Quarry and developed into a subsurface smoldering event (SSE). The Department's Waste Management Program oversees the remedial activities for the SSE.

On May 13, 2013, Bridgeton Landfill, LLC entered into an Agreed Order with the State of Missouri to address the SSE and control emissions/odors. Under the order, Bridgeton Landfill, LLC established the necessary infrastructure to isolate, contain, and monitor the SSE. This included modifying the South Quarry gas and leachate collection systems, installing a synthetic cap over all of the South Quarry and most of the North Quarry, and constructing an on-site leachate treatment system. On June 29, 2018, a final consent judgement was reached between the State of Missouri and defendants Bridgeton Landfill, LLC, Allied Services LLC, and Republic Services Inc. to address protection of human health and the environment and to resolve the State's Petition related to Bridgeton Landfill. The petition is the original complaint or lawsuit filed by the State to the court requesting court action. It is different legal action than the Agreed Order.

EPA also negotiated orders in response to the SSE in an effort to prevent potential migration into OU-1 Area 1. In April 2014, EPA negotiated a preconstruction order for an isolation barrier and negotiated the order for the barrier system in April 2016. Elements of the barrier system include: implementation of a heat-extraction system; contingent actions, such as implementation of Inert Gas Injection wells; installation of additional temperature-monitoring probes; installation of two National Ambient Air Quality Standards (NAAQS)-level SO₂ monitoring stations, and collection of the data for a one-year period; and phased installation of Ethylene Vinyl Alcohol (EVOH) cover over the North Quarry area.

Inactive Sanitary Landfill

On March 14, 2019, EPA ordered Bridgeton Landfill, LLC to resume remedial design of the remedy for the Inactive Sanitary Landfill in coordination with the design for the OU-1 amended remedy.

OU-3 Actions:

Groundwater sampling was performed on the site property from 2012 to 2014, and results indicate that site-related contamination is present in some of the monitoring wells located at the west and northwest property boundary. On Feb. 6, 2019, EPA and the RPs entered into a consent order to further investigate the extent of contamination and determine needed action to protect public health and the environment. The RP implemented an investigation program.

On April 15, 2022, the Department conducted the Fiscal Year 2022 annual inspection. A subsurface smoldering event, first reported in 2010, is still active in the OU-2 Former Active Sanitary Landfill. The Waste Management Program continues to monitor this event, as well as corrective actions taken as needed. Bridgeton Landfill, LLC is implementing stormwater improvements for OU-2 to resolve deficiencies identified from storm-water monitoring. The RP continues to maintain the non-combustible cover over portions of OU-1 where RIM is at or near the surface in accordance with the requirements of the Unilateral Administrative Order.

General Geologic and Hydrologic Setting:

The West Lake Landfill site has existed since the 1950s. Landfilling occurred by excavation and filling on the Missouri River geomorphic flood plain and by filling in a limestone quarry adjoining the flood plain landfill. The quarry is located in the St. Louis Limestone, which crops out along the eastern slopes of the Missouri River flood plain. Currently, the Earth City Levee system, designed to exceed 500-year flood levels, protects the area.

The Missouri River alluvium consists of 15 to 20 feet of silt loam to very silty clay, with moderate permeability. The groundwater table occurs at depths of 15 to 20 feet below flood plain level. Fluctuations of 5 to 15 feet occur when prolonged wet seasons affect the level of the Missouri River.

Beneath the very silty clay, a general increase in grain size, associated with increasing depth, characterizes the Missouri River alluvial sediments. Sand becomes noticeable at depths of 20 to 30 feet, with gravel

beginning to occur at depths of 30 to 40 feet.

Public Drinking Water Advisory:

No public water systems are located in the immediate vicinity of West Lake Landfill. However, the site is less than 2 miles from the Missouri River, which is the water source for Missouri American - St. Louis County / St. Charles County Public Water Supply System's North Intake. The intake for that plant is approximately 8 miles downstream from West Lake Landfill. If contamination from the site reaches the Missouri River, it could affect the downstream public water system. The selected remedy for West Lake Landfill includes long-term monitoring of groundwater beneath the site to address this issue.

Health Assessment:

OU-1 Health Assessment

The 2008 ROD identified eight radionuclides as chemicals of concern (COCs) based on their long half-lives: U-238, U-235, Th-232 and their associated daughter products, U-234, Th-230, Ra-226, lead-210, and protactinium-231. Because U-238, U-235, Th-232, and many of the daughter products were detected at levels above the site-specific background, all of the radionuclides in the uranium series (U-238 and decay products), the actinium series (U-235 and decay products), and the thorium series (Th-232 and decay products) have now been identified as COCs.

The 2008 ROD identified four non-radiological COCs, including three trace metals: arsenic, lead, and uranium as a metal; and one pesticide/polychlorinated biphenyl (PCB), Aroclor 1254. The updated 2018 human health risk assessment (HHRA), utilizing all the site data to date, identified 24 non-radiological contaminants as COCs, including the four previously identified. The additional COCs include: the trace metals antimony, barium, beryllium, chromium, cobalt, mercury, nickel, thallium, vanadium, and zirconium; the PCBs Aldrin, Aroclor 1242, Aroclor 1248, and Dieldrin; the semi-volatile organic compounds naphthalene and pentachlorophenol; and the volatile organic compounds (VOCs) 1,1-dichloroethane, 1,4-dichlorobenzene, benzene, chlorobenzene, and ethyl benzene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

In 2015, the federal Agency for Toxic Substances and Disease Registry (ATSDR) released a public health consultation that evaluated radiation in groundwater and air at West Lake Landfill OU-1. ATSDR concluded that inhalation of either radon gas or dust particles containing uranium and thorium decay products, which emit gamma radiation, (e.g., radium-226, radium-228) from surface disturbances at OU-1, may pose a health risk to landfill workers, including an increased risk of lung cancer. See OU-3 Health Assessment for more information on groundwater.

Based upon the 2018 HHRA, under current land use conditions, the human health risk from exposure to site-related contamination for both on-site soil (Area 1, Area 2) and off-site soil (Buffer Zone/Crossroad property (Lot 2A2)) is not outside the acceptable range set for protection of public health. The upcoming remedial action planned for Area 1 and Area 2 will mitigate the distant future excess estimated risks for exposure to gamma radiation (on-site worker) and radon (off-site farmer and off-site industrial worker) from uranium and thorium decay.

In the past, the Missouri Department of Health and Senior Services (DHSS) completed an exposure assessment for the site that included a well survey, water sampling, and a health questionnaire. In 1988 and 1989, water samples from private drinking water wells located within a 1-mile radius of the site were tested for radiological (gross alpha) and pesticide contamination. Results of the health questionnaire did not reveal any patterns of adverse health effects consistent with exposure to the hazardous materials at the landfill. None of the water samples had gross alpha levels exceeding EPA's MCL of 15 picocuries per liter (pCi/L). Water samples did not detect pesticides. The wells that were tested are no longer in use. See OU-3 Health Assessment for more discussion on groundwater.

On-site and off-site air sampling data is available on EPA's website. Routine on-site and off-site air sampling includes both gross alpha and gross beta radioactivity, radon, gamma spectrometry and dose, and VOCs.

During the April 2014 to July 2015 period, results of off-site air sampling are indicative of urban background.

For the June 2018 through September 2019 period, results of on-site sampling show the isotopic and gamma spectroscopy results for uranium-238, thorium-230, and combined radium are below Nuclear Regulatory Commission limits for public exposure. The results for gross alpha and gross beta radioactivity, as well as for VOCs, generally are consistent with EPA's previous year-long monitoring effort at five off-site locations, including one monitoring station placed in Spanish Village. Monitoring of ambient air continues on a routine basis.

According to EPA's second 2018 quarterly monitoring report for August through October, on-site radon ambient air results at levels in four locations were comparable to those detected prior to installation of the non-combustible cover. All other results for radon in 2018 were reported as not detected. Monitoring continues on a routine basis.

EPA recently required collection and radiological analysis of stormwater and sediment samples. When compared, the stormwater results are lower than EPA's risk-based screening levels. DHSS concluded that the exposure scenario used for the calculation is reasonable. Analytical results for the sediment samples, except for one, are below threshold levels defining RIM. The department's Environmental Remediation Program's Federal Facilities section will continue to evaluate sampling needs and sample results as part of the design of the remedy. For FY23, EPA is requiring the responsible parties to perform additional sediment sampling in several areas, including the area where EPA found the elevated RIM.

The Department maintains copies of routine sample results for all OUs.

OU-2 Health Assessment

In September 2018, DHSS and ATSDR released a draft public health consultation that evaluated fugitive gas emissions in ambient air near Bridgeton Landfill OU-2. Based on ambient air data the Department collected from 2013 through July 2018, DHSS/ATSDR concluded that, in the past, breathing sulfur-based compounds might have harmed the health of people living or working near the landfill by aggravating chronic respiratory disease or by causing respiratory effects such as chest tightness or difficulty breathing, especially in sensitive individuals. Health risks decreased following the OU-2 actions to control fugitive gas and odor emissions associated with the SSE at the landfill. Because the OU-2 control measures effectively reduce airborne sulfur-based compounds, breathing ambient air near the landfill is now unlikely to harm people's health. DHSS/ATSDR finalized the health consultation in 2022, which includes responses to public comments. The document is available on the DHSS' Bridgeton Landfill website at health.mo.gov/living/environment/bridgeton/.

OU-3 Health Assessment

EPA designated an additional operable unit, OU-3, specifically for investigating groundwater at the site. Results of comprehensive groundwater sampling, performed from 2012 to 2014, indicate that site-related contamination is present in some of the monitoring wells located at the property boundary, both on the west and northwest. Although groundwater in these monitoring wells exceeds the health-based goals, there are no current or foreseeable domestic uses for the groundwater. Because domestic use of groundwater is the basis for the health-based goals, risk of adverse health effects from exposure to groundwater contamination is not expected.

In 2015, ATSDR released a public health consultation that evaluated radiation in air and groundwater at West Lake Landfill OU-1. ATSDR does not expect radon gas in the air or radioactivity in groundwater to pose increased public health risks, since radon gas concentrations in ambient air are well below levels of health concern, and the groundwater is not used as a public water supply. ATSDR recommends due diligence to prevent future migration and contamination. See OU-1 Health Assessment for more information on air.

In late 2020, EPA approved a remedial investigation work plan to investigate potential site-related impacts to groundwater.

EPA is planning to further assess the potential for exposures to on- and off-site groundwater in the near future. Long-term institutional controls are in place to control exposure to on-site groundwater. For off-site groundwater, the city of St. Louis enforces an ordinance that restricts drilling drinking water wells. With these controls in place, public exposure to potentially contaminated groundwater is not likely. For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO, 65102-0570, 573-751-6102.

Zykan Property

Site Name: Zykan Property

Classification: Class 2

Date of Registry Placement: March 9, 1987

Site Address: 1251 Muenz Road, Wright City, Warren County, MO, S 1/2, S 1/4, Sec. 32, T47N, R1W, Wright City Quadrangle

Present Property Owner: LaVerne A. Zykan Trust

Lead Agency: Missouri Department of Natural Resources (Department) - Zykan Landfill; U.S. Environmental Protection Agency (EPA) - BHS Landfill

Waste Type: Inorganics, organics, heavy metals, paints, pigments, pesticides, and ignitable waste

Quantity: Not determined

Site Description and Environmental Concern:

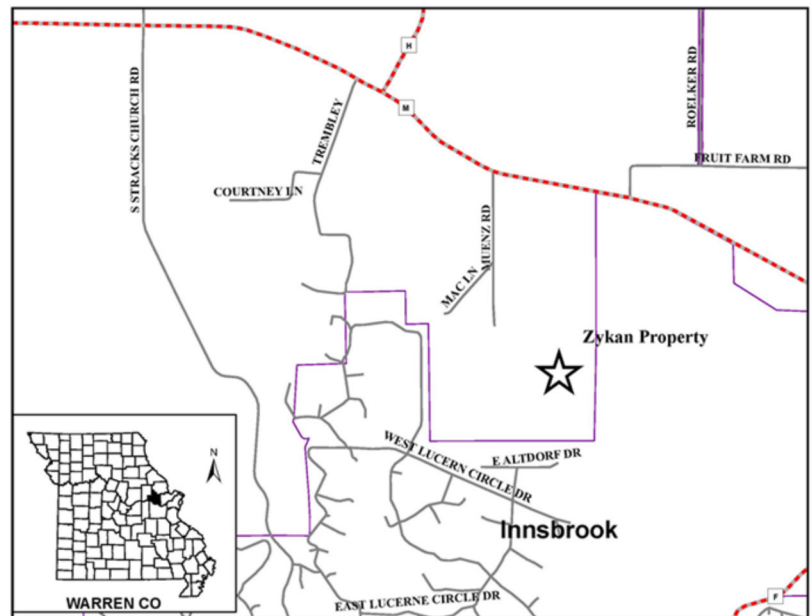
The Zykan Property site contains two permitted landfills: the Zykan Landfill (permitted as Bob's Home Service, Inc., Sanitary Landfill, permit #0121901) on the property's south side and BHS Landfill (permitted as Bob's Home Service, Inc., Special Industrial Waste Disposal Facility, permit #0721901) located on the property's north portion.

The Zykan family owned the residential/commercial property where the landfills are located, and Bob's Home Service, Inc. operated the landfills. The Zykan Property is approximately 158 acres, which include a residence, cropland, and the two permitted landfills. The site is located about 3 miles southwest of Wright City in Warren County.

BHS Landfill Site History and Remedial Actions - The BHS Landfill operated from 1977 until 1985, filling approximately 12 acres of the site. It is comprised of a 9-acre industrial landfill, known as Area 1, and a 3-acre hazardous waste landfill, known as the PTA, which is located directly north of Zykan Landfill. Area 1 ceased accepting waste in 1982. Since its closing, many of the suspected industrial wastes have been classified as hazardous substances. The PTA began operations in 1982 under federal interim status and a state-issued hazardous waste permit. The PTA closed in 1986 under a Closure and Post-Closure Plan approved by the Missouri Department of Natural Resources (Department). The Department acted as the principal authority for the BHS Landfill until 2008. After 2008, the U.S. Environmental Protection Agency (EPA) became the lead agency for activities at the BHS landfill. The landfill is inactive.

Site groundwater investigations documented the following contaminants: vinyl chloride; bis(2-ethylhexyl) phthalate; 1,2-dichloroethane; cis-1,2-dichloroethene; 1,1-dichloroethane; hexavalent chromium; arsenic; cadmium; chromium; and lead in groundwater samples at concentrations above health-based benchmarks. Groundwater investigations also found: chlorobenzene; 1,1-dichloroethane; toluene; naphthalene; o,p-dichlorodiphenyldichloroethane (DDD); barium; iron; manganese; and ammonia below health-based benchmarks.

A February 2002 wildfire burned through a portion of the PTA Landfill and burned a storage building, waste tires, and miscellaneous scrap and debris. The May 2004 groundwater monitoring and leachate removal at the BHS Landfill saw approximately 10,000 gallons of leachate removed from the leachate collection sump



and disposed of off-site at a permitted waste facility.

In August and September 2008, an additional 10,000 gallons of leachate was removed from the BHS Landfill leachate collection sump. In September 2013 and January 2014, similar actions took place for the leachate inspection and sampling, followed on June 3, 2015, by an additional 10,000-gallon purge of leachate.

In 2005, EPA placed a \$755,782 lien on that portion of the Zykan property where the removal actions occurred. EPA pursued the potential responsible parties on the BHS landfill under a RCRA 7003 Order, dated January 2011. The draft order covers only the BHS Landfill, because the potential responsible parties argued that they never placed any waste in the sanitary Zykan Landfill. Negotiations between the BHS Generator Group and EPA resulted in the July 24, 2015, letter from EPA to the BHS Generator Group, setting forth a framework for the BHS Generator Group to provide site maintenance, surface water monitoring, and groundwater monitoring, while the parties continue to work toward a comprehensive agreement for the BHS Landfill.

Groundwater monitoring at the BHS Landfill continues, with the number and concentration of contaminants remaining generally consistent with values from previous sampling events. Detection of hexavalent chromium above the applicable screening value exists in the southeast portion of the Bob's Home Service landfill. The concentrations observed for cis-1,2-dichlorethene and vinyl chloride are indicative of continued anaerobic degradation of the higher chlorinated compounds. EPA agreed to conduct surface water sampling of the adjacent seasonal stream, or dry creek, which runs east of the two landfills. In February 2020, the Department collected and analyzed three surface leachate samples for volatile organic compounds (VOC), RCRA metals, and hexavalent chromium. None of the contaminants of concern exceeded applicable screening values.

During the PTA's operation, BHS was required to pay into a post-closure trust an amount equal to the combined closure and estimated post-closure maintenance costs. However, BHS failed to fully fund this trust, and due to a bankruptcy, BHS has not funded the trust since December 2009. The BHS Landfill is a closed federal interim hazardous waste landfill-status facility (designated as BHS for RCRA). In an effort to maintain the landfill, LaVerne Zykan contracted a consultant to take care of minimal post-closure maintenance.

Zykan Landfill Site History and Remedial Actions - The permitted Zykan Landfill operated from 1971 until 1977, filling approximately 14 acres of the site. Materials disposed of at the landfill included miscellaneous trash, household garbage, and unidentified industrial waste. Some wastes disposed of at the Zykan Landfill were similar to the wastes disposed of in the BHS Landfill.

The landfill ceased accepting waste in 1977. A vegetated cap, which was added after closing, remains intact. The Zykan landfill is also inactive. Since closure was completed at the Zykan Landfill, site inspections have revealed erosional gullies, leachate outbreaks, and overall landfill deterioration. Currently, the Department's Waste Management Program provides primary oversight for the Zykan Landfill, since it has authority over solid and hazardous waste landfills.

In 1991, EPA inspected the Zykan Landfill, documenting erosion and leachate outbreaks. EPA issued a notice of violation in November 1991. In January 1992, EPA referred Zykan Landfill to the Department; however, the Department did not pursue legal action because the owner was financially insolvent. From January 1992 through 1995, yearly closure site inspections revealed that no remedial actions had occurred to correct the ongoing leachate outbreak and eroded gullies at the Zykan Landfill. In June 1995, the Department issued a notice of violation.

A 1996 Registry inspection of Zykan Landfill revealed exposed drums in a drainage ditch leading to Charrette Creek and a leachate outbreak on the landfill's south slope. In February 1998, EPA completed a Time-Critical Removal Action, which consisted of stabilizing the erosional areas and the buried drum area, sampling and removing any visible drums, and initiating long-term site management. In fall 1998, all areas disturbed during the removal were regraded and hydro-seeded. The installation of a new fence and gate system established security at the site.

In 1999, EPA conducted an Expanded Site Inspection (ESI) to assess the threat the Zykan Landfill posed to human health and the environment via contaminated surface water and groundwater. Due to previous removal activities at the landfill, the ESI concluded that the site currently posed minimal or no threat to human health and the environment. On July 31, 2000, all site activities were determined to be complete, except the long-term site management issue.

In July 2019, the Department conducted an inactive landfill inspection of the sanitary landfill and documented

a leachate outbreak on the south slope. The leachate was not discharging off site at the time of inspection, but it could flow off site into a tributary of Charrette Creek during rain events. This outbreak is ongoing, as documented during previous inspections.

On May 3, 2022, the Department conducted the Fiscal Year 2022 annual inspection. The inspector noted that the landfill cap is well vegetated in most areas. Two areas of erosion, previously noted during the 2019 inspection, are still present. No leachate was observed during the most recent inspection.

Long-Term Stewardship and Future Actions at the Site - A partially funded post-closure trust fund has reimbursed the Department for long-term monitoring and maintenance activities. Since the main contributors, "Friends of Zykan Landfill," negotiated to maintain only the BHS Landfill portion of the Zykan Property, this trust fund continually decreases. Remaining funds in the post-closure trust fund contribute to maintaining post-closure care agreements, such as maintaining and monitoring the Zykan Landfill. In 2015, the Potentially Responsible Parties, Bob's Home Service Generator Group (BHS Generator Group), and EPA established a framework for the BHS Generator Group to provide limited site maintenance and groundwater monitoring to form a comprehensive agreement, an Administrative Order on Consent to manage post-closure care and corrective action activities.

In March 2018, the Department (Environmental Remediation Program) allowed 30.89 acres of the Zykan Property to be sold to an individual. This tract of land, which is east of and adjacent to the BHS Landfill, was not believed to have been filled with any waste.

EPA continues to work toward an Administrative Order on Consent for the Zykan Property, and in June 2020, began drafting the Statement of Basis, which will determine final remedy proposals.

EPA denied the BHS Generator Group's petition to delist leachate generated from the BHS Landfill as hazardous waste in August 2021.

General Geologic and Hydrologic Setting:

The site is located in an upland setting in the watershed of a tributary to Charrette Creek. On-site soils are composed of 10 to 20 feet of loess overlying thick deposits of glacial drift. The upper 50 to 75 feet of drift is composed of till, characterized by dense, low permeability sandy and silty clay. This material provides an effective barrier to downward percolation, or movement of contaminants. Therefore, lateral leakage from the filled areas is the primary concern. Groundwater supplies within the glacial till are extremely limited. Natural conditions are well suited for preventing contamination of drinking water supplies.

Public Drinking Water Advisory:

St. Charles Co. PWSD #2 – Warren uses one active well, located approximately 1 mile southwest of the landfill, and one emergency well, located approximately 2 miles south of the landfills. Casing for the well closest to the site is 567 feet, and the emergency well is cased to 337 feet deep. Innsbrook uses two wells that are located approximately 2 miles southeast and 2 miles southwest of the site, with casings extending to depths of 550 feet and 475 feet, respectively. Maple Ridge MHP uses one active well, located approximately 1.6 miles northeast of the site, which is cased to approximately 502 feet deep. Valley Lake Estates uses one active well, located approximately 2.2 miles east of the site, which is cased to 572 feet deep. All of these wells draw water from the northern margin of the Ozark aquifer. Contamination from the site is not likely to affect these wells due to relatively low permeability within the glacial till deposits that overlie bedrock in this region.

Health Assessment:

Contaminants of concern at this site include inorganics, organics, heavy metals, paints, pigments, pesticides, and ignitable waste. Additionally, chlorobenzene, toluene, barium, 1,1-dichloroethane, naphthalene, manganese, and ammonia were detected at levels above EPA's Regional Screening Levels. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Missouri Department of Health and Senior Services (DHSS) conducted sampling of private drinking water wells in the area surrounding the BHS and Zykan Landfills. This surveillance revealed no drinking water contamination. DHSS conducted the last round of sampling in November 2005 and identified two private wells in the direction of downgradient groundwater flow from the site. DHSS considered these wells too far away for site wastes to affect them because of the slow rate of groundwater movement. Based on that finding, DHSS discontinued private well sampling in this area.

Following the 2019 observation of on-site leachate breakouts, the Department conducted an additional investigation to ensure no contaminants were migrating off site. Surface sampling near the leachate outbreaks showed no detections above levels of concern. The Department did not observe any leachate outbreaks in the 2020, 2021, or 2022 site inspections. One monitoring well showed detections of VOCs that are indicative of degradation of higher chlorinated compounds. As long as the cap remains intact, this site does not pose a significant public health risk at this time.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

CLASS 3 SITES

Acme Battery

Site Name: Acme Battery

Classification: Class 3

Date of Registry Placement: December 19, 1996

Site Address: 3340 and 3344 Morganford Road, St. Louis, St. Louis City, MO

Present Property Owner:
Remains, Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Heavy metals (lead)

Quantity: Not determined



Site Description and Environmental Concern:

The ACME Battery site is a former battery manufacturing plant that used lead in its production operations. As a result, lead has contaminated site soils.

The privately-owned former battery-manufacturing site totals approximately 3 acres in size and is located in a mixed commercial/light industrial area, with private residences located to the east. Remains, Inc. operates a textile recycling business in a site building, located at 3340 Morganford Road (referred to as the north building). The other site building, located at 3344 Morganford Road (referred to as the south building), is vacant.

ACME produced batteries from 1963 until May 1997, when it stopped operations in response to a complaint that lead contamination was migrating to the adjacent International Foods property.

During a 1988 site inspection, U.S. Environmental Protection Agency (EPA) discovered total lead and leachable lead in soil at much higher levels than considered safe for unrestricted property use. In 1996, ACME took actions to prevent contamination migration and to reduce the amount of lead-contaminated soil. High levels of lead remain in soil, but an asphalt cap installed in 1994 prevents exposure to the contaminated soil.

Remedial Actions:

In 1993, ACME and EPA entered into an Administrative Order on Consent to address lead contamination. In 1994, ACME capped a portion of the site and agreed to place a deed restriction on the capped area and maintain the integrity of the cap.

In 1996, ACME took actions to prevent migration of contamination off its property in response to a complaint that lead was migrating to the adjacent International Foods property. These actions included installation of a retaining wall and application of limestone to prevent surface runoff from ACME to International Foods. ACME discontinued operations at the site in 1997, which involved equipment cleaning and removal, and off-site disposal of remaining battery acid. ACME removed and stockpiled two dumpsters worth of soil that had failed the Toxicity Characteristic Leaching Procedure.

After the Missouri Department of Natural Resources (Department) issued several notices of violation, the state of Missouri filed a suit against ACME Battery for failure to properly manage and dispose of this

hazardous waste-contaminated soil. Missouri and ACME settled the suit in 2000 and hired Envirotech, Inc. to dispose of the hazardous waste. Afterwards, ACME gave Envirotech permission to use the north building for warehouse and office space. Later in 2000, the St. Louis Development Corporation's (SLDC) Land Reutilization Authority took ownership of the site via a tax auction. Analysis of wipe samples taken inside the north building, occupied by Envirotech, showed lead at levels ranging from 64 to 29,635 times the residential screening levels. In 2001, Envirotech vacated the premises because of the extremely high lead levels. In 2003, the SLDC enrolled the site in the Department's Brownfields/Voluntary Cleanup Program (BVCP). In 2005, Remains, Inc. purchased the property from the SLDC and continued participation in the BVCP.

Activities conducted to date under Department oversight include: repairs to and expansion of the asphalt cap; removal of contaminated soil; asbestos abatement, and demolition and reconstruction of the north building's west side; decontamination of the entire north building; and removal of a heating oil underground storage tank. Remains, Inc. set up textile recycling operations in the north building's east side after completing decontamination in 2006.

In August 2010, the Department approved change-of-use requests for constructing a semi-permanent, fabric-covered structure on the property's southeast end for Remains, Inc. to use for textile storage. In September 2016, the Department approved another change-of-use request to expand the recycling operation in the north building's east side to the newly-reconstructed west side. Remains, Inc. plans to address the remaining areas of uncapped soil and the south building.

On March 23, 2022, the Department conducted the Fiscal Year 2022 annual inspection. During the inspection, the Department documented that the site cap is in good condition with only minor cracking.

General Geologic and Hydrologic Setting:

The site is located on gently rolling uplands consisting of wind-blown loess, a type of soil that exhibits low to moderate permeability. A thin zone of residual clay soil, developed from the underlying bedrock, occurs at 20 to 30 feet below grade. Bedrock, composed of undifferentiated Pennsylvanian-age shale, coal, and sandstone, is present to a depth of about 60 feet below grade. Past coal and clay mining of the Pennsylvanian units created artificial conduits within the uppermost bedrock. Thick sequences of Mississippian-age and older limestone formations occur at greater depths. Solution enlargement of bedding planes and joints is common in the limestone units.

Extensive grading produced a flat terrain, which tends to pond water, allowing infiltration through the surface soil. Infiltrated water could enter the artificial (mined) conduits within the uppermost bedrock, rapidly impacting the underlying aquifer.

Some low-yield wells in the St. Louis area produce potable water from the Mississippian bedrock aquifer. Water from underlying bedrock units is mineralized and not used for potable water.

Public Drinking Water Advisory:

The city of St. Louis uses the Missouri and Mississippi rivers as a primary source of public drinking water, and no impacts are expected.

Health Assessment:

The contaminant of concern at this site is lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant. The primary health concern is human exposure from ingestion of lead-contaminated soil and inhalation of lead dust. Based on available information, this site does not appear to pose a significant public health risk at this time. However, if site conditions were to change such that exposures to contaminated soils were to occur, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

AMERECO Environmental Services

Site Name: AMERECO Environmental Services

Classification: Class 3

Date of Registry Placement: September 10, 2003

Site Address: 1483 SW 58 Highway, Kingsville, Johnson County, MO

Present Property Owners: Jared Sisk

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Ignitable fuel blending process hazardous waste and heavy metals

Quantity: Not determined

Site Description and Environmental Concern:

The AMERECO Environmental Services site, also referenced as West Star, is a former hazardous waste treatment, storage, and disposal facility. The facility accepted a variety of hazardous and non-hazardous waste from off-site sources for storage, treatment, and brokering to other facilities. When site operations ceased, characteristic hazardous waste remained in on-site tanks. The site now requires proper closure under the Resource Conservation and Recovery Act (RCRA).

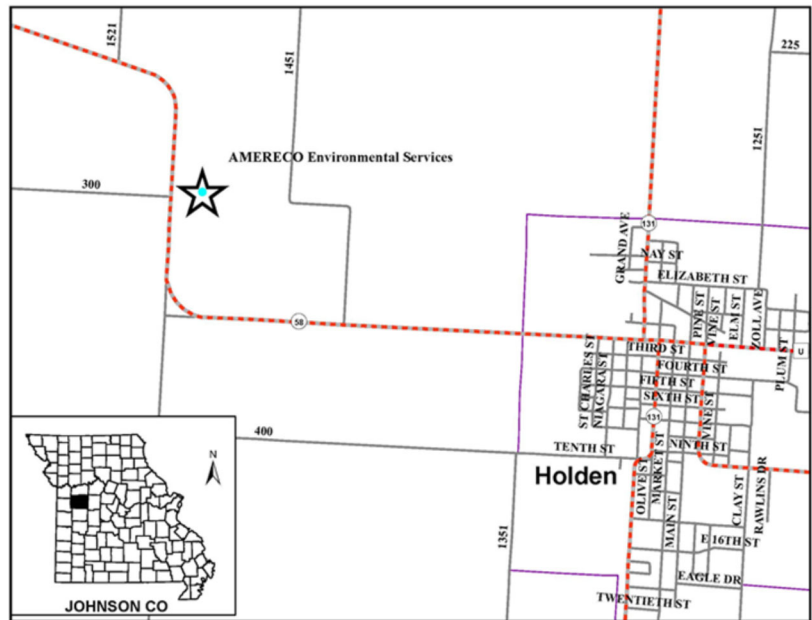
The privately-owned site is 54 acres in size and located in a rural agricultural setting. The nearest residential structure is adjacent to the site. The West Star facility no longer operates, but several buildings remain with marginally functional fencing, gates, and signs. The southern end of the former consolidation and blending building, referenced as RCRA2, contains several above-ground storage tanks located in secondary containment structures.

This facility accepted hazardous waste between 1985 and 2002. It did business under multiple owners and various company names, including PCB Disposal Systems, AMERECO Environmental Services, Essex Waste Management Facility, and West Star Environmental, Inc. Since closing, the responsible parties and the U.S. Environmental Protection Agency (EPA) removed most of the tank wastes.

Following these removal actions, EPA left waste sludge in the bottom of the tanks and pipes, which allows potential for a release of hazardous substances to the environment. While the Missouri Department of Natural Resources (Department) does not believe any releases to the environment have occurred, proper characterization and disposal of residual hazardous waste material in the tanks is required under RCRA to ensure protection of public health and the environment.

Remedial Action:

The West Star site has a long and complex history of violations and corrective action under RCRA. On July 6, 2000, because of the continuing violations, the Department issued a Notice, Order to Close, and Permit Revocation as one action in one document to West Star. Although West Star appealed the order, the Missouri Hazardous Waste Management Commission ruled in June 2002 that West Star must close according to the order. However, West Star did not begin closing the facility as directed by the commission. Consequently, the Department initiated actions to close the facility and remove waste. At the Department's



request, various hazardous waste generators assumed responsibility for disposal of a portion of the remaining waste. In 2002, these generators had transported much of the remaining hazardous waste inventory, in bulk or in drums, to an approved off-site RCRA facility for treatment and/or disposal. Because the insurance company that provided the financial assurance instrument to ensure proper closure was liquidated, any waste that the generators did not claim remained on site.

On Dec. 18, 2002, having exhausted its means of waste removal, the Department's enforcement section referred the West Star site to the Department's Superfund section for further investigation. In December 2003, the Department requested EPA's assistance in removing flammable waste from the site. On May 10, 2004, EPA removed approximately 10,000 gallons of flammable liquid; however, EPA contractors could not vacuum the remaining non-flowable waste sludge from the bottom of the tanks in RCRA2.

In 2006, the Department's Superfund section initiated an integrated Preliminary Assessment/Site Inspection/Removal Assessment investigation of the site. The investigation's primary objectives were to: obtain data to identify and characterize containerized waste; locate and identify potential sources of contamination; attempt to delineate the extent of the hazardous substances present in surface or subsurface soil and surface water; and, assess the threat to public health and the environment.

Groundwater samples collected from nearby drinking water wells were below health-based benchmarks for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), and metals. On-site surface and subsurface soil samples also were below health-based benchmarks for VOCs, SVOCs, polychlorinated biphenyls (PCB), and metals. Surface water and sediment samples collected both on and off site did not show VOCs or SVOCs above health-based benchmarks. The Department's sampling detected cadmium and lead, at levels above some health-based benchmarks, in sediment collected from West Pin Oak Creek and a tributary to the creek. The Preliminary Assessment/Site Inspection/Removal Assessment concluded that, based on the current site conditions and available information, the site did not warrant further Comprehensive Environmental Response, Compensation, and Liability Act action. However, the Department's RCRA program is working with the site owner to complete final closure relating to the on-site tanks that contain hazardous waste from the ignitable fuel blending process.

On July 28, 2022, the Department conducted the Fiscal Year 2022 annual inspection and reported that the property remains in general disrepair. Tanks and other debris remain on site, as well as some commercial mechanical equipment and old wood salvaged from a sunken riverboat.

General Geologic and Hydrologic Setting:

The West Star site is located within the unglaciated Osage Plains section of the Central Lowlands physiographic province. Topographically, the site is located amid rolling hills of an upland setting to the northeast of Kestersen Lake and along the north shore of West Pin Oak Creek.

About 20 feet of residual silty clay soils cover Pennsylvanian-age bedrock of the Marmaton Group. Shaley-limestone, sandstone, and coal make up the Marmaton Group. Both the surficial material and underlying bedrock are considered to have a low hydraulic conductivity.

Shallow groundwater is present in the residual soils; however, yields and quality generally are low. The approximate location of the uppermost water table is at the contact between the fine-grained surficial materials and the shaley-limestone bedrock, with a flow direction toward the northeast. Groundwater in this unconfined water-bearing zone is not present in sufficient quantities for regular domestic use. Deeper wells drilled into upper Marmaton Group produce small amounts of mineralized potable water. Groundwater mineralization increases significantly with depth. As a result, no local water wells draw water from wells drilled deeper than 650 feet below ground surface.

Public Drinking Water Advisory:

Johnson Co. PWSD #2 uses groundwater wells, but all wells are located in the eastern half of Johnson County. No impacts to public drinking water sources are expected.

Health Assessment:

The types, volume, and instability of containerized hazardous waste stored at this facility is uncertain. Heavy metals such as arsenic, lead, cadmium, and mercury can cause a variety of health concerns, including negative effects on every organ system. The following compounds were present in on-site containers at concentrations exceeding their toxicity characteristic leaching procedure regulatory limits: Eight metals; 31 VOCs, such as benzene, 2-butanone, chloroform, tetrachloroethene, and trichloroethene; 11 SVOCs; and, PCBs.. See Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Based on available information, a public health threat exists at this site. Characterization of the site's contaminants is not complete. The possibility of human exposure exists due to the marginally functional fencing, gates, and signs.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Amoco Oil-Sugar Creek Refinery

Site Name: Amoco Oil-Sugar Creek Refinery

Classification: Class 3

Date of Registry Placement: June 14, 1984

Site Address: 1000 North Sterling, Sugar Creek, Jackson County, MO - Five areas contained in Sec. 28, W 1/2, Sec. 27, N 1/2, Sec. 33, R32W, T50N of the Independence Quadrangle and N 1/2, Sec. 8, R32W, T50N, NW 1/2 Sec 27, R32W, T50N of the Liberty Quadrangle

Present Property Owners: BP Products North America, Inc.

Lead Agency: Missouri Department of Natural Resources (Department) - post closure and technical corrective action lead, and U.S. Environmental Protection Agency (EPA) - administrative corrective action

Waste Type: Lead and lead compounds, cadmium, polycyclic aromatic hydrocarbons, oil and sludges, chromium, arsenic, mercury, benzene, toluene, ethyl benzene, MTBE, and xylene

Quantity: Not determined

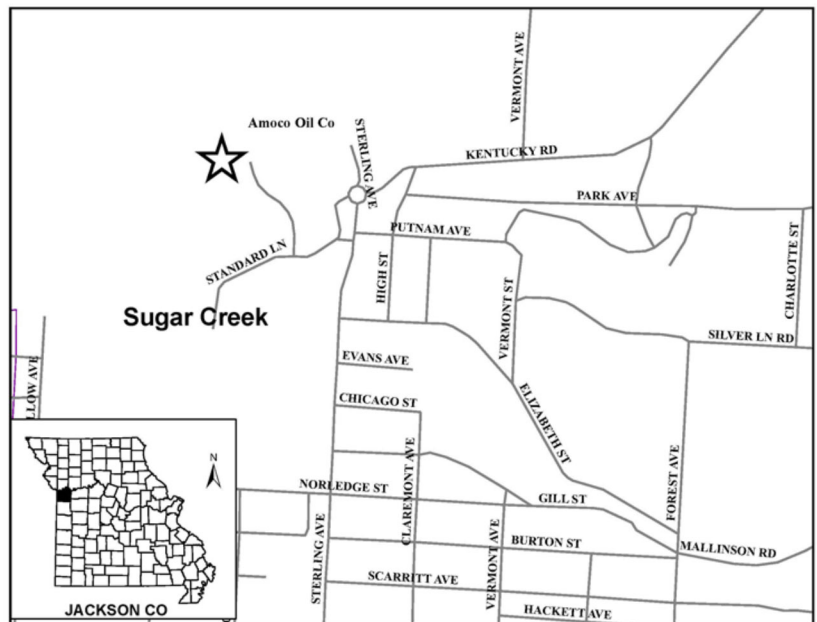
Site Description and Environmental Concern:

The Amoco Oil – Sugar Creek Refinery site is a former oil refinery where environmental sampling determined that petroleum hydrocarbons are present in soil, groundwater, and surface water as the result of past refinery operations. Lead-contaminated soil also is present in portions of the site. Amoco Oil merged with British Petroleum (BP) in 1998, and the name changed to BP in 2001. The privately-owned site is approximately 423 acres in size and located in a manufacturing setting. Private residences are located to the south. Buckeye Partners LLC operates a petroleum pipeline terminal on a portion of the property. The city of Sugar Creek's police and fire stations also are located on the property.

The site is located south of the Missouri River, near the junction of Sugar Creek and the Missouri River. Sugar Creek bisects the property. The former refinery plant is located on an upland area, while the disposal facilities are located in the flood plain. The portion of the upland area west of Sugar Creek consists of rolling hills and dense forest. A portion of the upland area east of Sugar Creek is mostly paved and contains several office buildings and storage tanks. The flood plain comprises open ground and the BNSF railroad right-of-way. The property is fenced, locked, and guarded.

The site is no longer an active oil refinery; oil refining occurred from 1904 to 1982. The Missouri Department of Natural Resources (Department) listed five separate disposal areas on the registry, totaling approximately 22 acres, located next to the Missouri River. The registered areas include five inactive sludge disposal areas. The U.S. Environmental Protection Agency (EPA) identified a land farm that had been used for the disposal of leaded gasoline storage sludge containing high concentrations of lead and chromium; the land farm closed in 1988. The land farm is located near the river.

Because the site is located adjacent to the Missouri River, flooding and groundwater contamination are the most likely means of both on-site and off-site contaminant transport. Groundwater discharge to the Missouri



River has had minor impacts to the water quality. The Missouri River and its alluvium provide public drinking water, including a major municipality.

Remedial Actions:

In the 1970s, Amoco Oil Company (Amoco), now BP Products North America Inc. (BP), began groundwater monitoring at the site. In 1981, Amoco began Resource Conservation and Recovery Act (RCRA) quarterly groundwater monitoring. Amoco developed and submitted a revised closure plan for RCRA interim-status units at the facility; however, these units are not part of the property listed on the registry. In 1986, Amoco completed dismantling of the process equipment, pipes, and tanks. In September 1987, the Department approved the closure plan for the surface impoundments. In April 1988, Amoco closed the RCRA leached tank bottom area. In 1999, Amoco completed bioremediation of the Solid Waste Management Unit (SWMU), as well as capping and closure activities.

On June 30, 1989, EPA issued Amoco a consent order requiring Amoco to: conduct a RCRA Facility Investigation (RFI) to investigate and characterize the entire site; conduct a Corrective Measures Study to evaluate remedy alternatives; and, select a final remedy for the entire site. In 2000, Amoco, now BP, EPA, and the Department agreed to divide the site to expedite work on priority areas. BP submitted RFI Reports and Corrective Measures Studies to the Department and EPA for review and approval. The documentation covered one off-site area, Norledge, and nine on-site areas: Crawford, Sugar Creek, West Bluff, West Plant Process, West Tank, West Hills Tank, Lower Refinery, Riverfront, and East Bluffs. On April 6, 2005, the Department issued BP a Corrective Action Abatement Order on Consent. Once EPA approves the final remedy for each area under its order, the Department's order addresses implementation of the final remedy for that area.

On Nov.30, 2006, EPA and the Department approved the final remedy for the Norledge off-site area. On May 12, 2008, EPA approved the final remedy for two of the on-site areas, Crawford and Sugar Creek. In 2015, EPA and the Department approved the RFI reports for the remaining on-site areas. In the same year, BP, EPA, and the Department decided to recombine the remaining areas for selection of a final remedy. In August 2016, BP submitted a draft Consolidated Final Remedy Proposal (CFRP) for all remaining areas that also revises the existing remedies for the on-site areas. On April 14, 2022, BP submitted its revised CFRP to the Department and EPA for review. The Department and EPA have reviewed the revised CFRP and are currently awaiting BP's response to comments.

BP implemented numerous interim measures to remove contamination from throughout the site, including soil and product removal, multi-phase extraction wells, horizontal extraction wells, interceptor trenches, vacuum truck recovery, passive skimming systems, and hydraulic control systems.

On April 14, 2022, the Department conducted the Fiscal Year 2022 annual inspection. The results of this inspection highlighted the need for distinctions between the registry-inspection areas and RCRA-regulated sections of the property. The Department noted that all inspection areas were well vegetated and undisturbed.

General Geologic and Hydrologic Setting:

The site is located near the junction of Sugar Creek and the Missouri River. The former plant is located on an upland area, while the disposal facilities are located in the flood plain.

Pennsylvanian-age limestone and shale bedrock is present in the upland area south of the river. Varying thicknesses of silty clay loess and weathered loess covers most of this area. The plant's disposal facilities are located on fill and alluvial soil of the Missouri River flood plain.

The bedrock underlying surficial material is considered to be of low permeability. Movement of contaminants is therefore most likely to occur through highly permeable alluvium in the valley, and to a lesser extent, through the loess.

Potential contaminants from the uplands are expected to move downgradient to the north, emerging at the flood plain. Contamination from the flood plain may move through the shallow alluvial material directly to the Missouri River.

Public Drinking Water Advisory:

The city of Independence's public water well field is located approximately 2.5 miles downstream of this site, and the nearest surface water intake is located in Lexington, Missouri, approximately 38 river-miles downstream. Although Independence draws water from shallow Missouri River alluvium, no site-related impacts are expected.

Health Assessment:

Water sampling identified lead, chromium, phenol, arsenic, mercury, benzene, toluene, and tetraethyl lead as chemicals of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Contaminated groundwater is the major pathway of concern. The average slope is less than 2%, which makes surface runoff unlikely, except when the Missouri River floods the area. Because the facility is isolated and access is restricted, exposure to site contaminants through direct (dermal) contact and inhalation should not pose a public health threat.

An exposure assessment conducted by the Missouri Department of Health and Senior Services uncovered no evidence of human exposure occurring off site. The nearest public drinking water wells are approximately 3 miles downstream. The site could adversely affect water quality of both the Missouri River and the alluvial aquifer.

Although no human exposure is occurring, based on the toxicity of the chemicals present and the known groundwater contamination, this site continues to pose an overall potential public health threat, especially through exposure to contaminated groundwater.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Armour Road

Site Name: Armour Road

Classification: Class 3

Date of Registry Placement: May 22, 1997

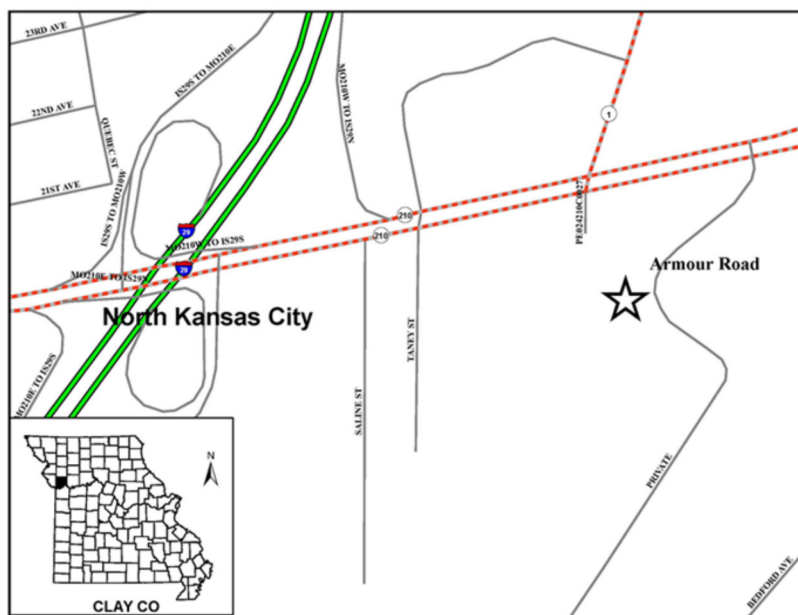
Date of National Priorities List Listing: May 10, 1999

Site Address: 2251 Armour Road, North Kansas City, Clay County, MO

Present Property Owners: KC Beaton Holding Company LLC

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Arsenic.



Quantity: In 2004, U.S Borax removed and disposed of approximately 1,400 tons of building material during a demolition action. In 2006, the company excavated, treated, and disposed of approximately 70,000 tons of contaminated soil. In 2017, Rio Tinto, the responding party since 2009, removed an additional 44,241 tons of contaminated soil from along the western boundary, and from under a roadway along the site's eastern border. The quantity of contaminated groundwater is unknown.

Site Description and Environmental Concern:

The Armour Road site is a former herbicide blending facility that used the following chemicals in formulating herbicides: arsenic; pentachlorophenol; sodium chlorate; 2,4-dichlorophenoxyacetic acid; and, 2,4,5-trichlorophenoxyacetic acid. The site has extremely high levels of arsenic contamination in soil and groundwater.

The privately-owned site property is approximately 1.8 acres in size, located between an industrial area and a residential neighborhood near the Missouri River. The property is adjacent to railyard warehouses, industrial facilities, and a commercial development zone. A restaurant and a parking lot are now located on the site property.

Herbicide mixing occurred from 1929 to 1986. General business operations and related spills are the probable source of soil and groundwater contamination due to mixing of herbicides containing arsenic.

Physical conditions at the site allowed arsenic to migrate into groundwater. The contamination is in the Missouri River alluvial aquifer that underlies the site. Analytical results from Missouri Department of Natural Resources (Department) sampling in June 1990 documented the presence of characteristic hazardous waste in the soil and groundwater. The analyses also documented the presence of hazardous waste constituents in the groundwater above a level of health concern. The prevailing direction of groundwater flow is to the southeast, toward the Missouri River. Based on current groundwater monitoring, arsenic in groundwater has not reached the Missouri River, and no downgradient water supply wells are located between the site and the river.

Remedial Actions:

The U.S. Environmental Protection Agency (EPA) and the Department conducted multiple investigations from 1989 to 2001. These studies documented exceptionally high arsenic concentrations in on-site soil from the

surface down to the water table, which is approximately 22-24 feet below the surface. As a result, EPA covered the exposed on-site soil with geo-fabric and gravel, and placed a 6-foot-high, chain-link fence at the property's south and east borders. In May 1999, EPA added the site to the National Priorities List.

Beginning in 1996, U.S. Borax accepted the role as a responsible party to address the arsenic-contaminated soil on the property. Between October 2004 and June 2006, U.S. Borax decontaminated, demolished, and removed buildings from the property, excavated soil to the water table at 24 feet, treated on-site soil as needed, and disposed of contaminated soil off site. U.S. Borax removed approximately 86,810 tons of soil containing a total of 1,990 tons of arsenic from the property. The company excavated contaminated soils to the site boundaries, as close as practical, and to a depth averaging 23 feet. Arsenic contamination in soil remained, because it was not possible to excavate the soil near and under a retail hardware store located along the western property boundary, or contamination near and under a service roadway along the property's southeastern border.

Studies conducted by Rio Tinto documented a significant decline in arsenic concentrations in the shallow groundwater interval, compared to data prior to the 2004-2006 removal action. Groundwater monitoring after the soil removal action further revealed that pentachlorophenol (PCP), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and 2,4,6-trichlorophenoxyacetic acid (2,4,6-T) concentrations declined to non-detect levels, compared to concentrations detected in groundwater during the initial site investigations conducted in the 1990s. As a result of these findings, only arsenic was considered a contaminant of concern when evaluating the site's future remedial groundwater alternatives.

In May 2013, Rio Tinto completed its soil and groundwater remedial investigation, then began a study of possible groundwater remedial alternatives. The arsenic-contaminated soil source that remained after the 2004-2006 removal action complicated the evaluation and selection of the groundwater remedy. In December 2014, Rio Tinto voluntarily agreed to remove the remaining soil source, to the extent possible, concurrently with a redevelopment plan proposed by the city of North Kansas City. In January 2017, Rio Tinto removed approximately 44,240 tons of contaminated soil, including 19,080 tons from the service roadway area (now Railroad Avenue), and 25,161 tons from the retail hardware store area. During the January 2017 Removal Action, the company removed a total of 27,724 kilograms of arsenic from the site. Following the removal action, Rio Tinto evaluated the removal action's effectiveness and performed a groundwater feasibility study to evaluate cleanup alternatives.

Removal actions resulted in the excavation of more than 131,000 total tons of contaminated soil from the site. The calculated total mass of arsenic removed is approximately 209,000 kilograms. Soil contamination remains beneath Armour Road on the site's north side, but it does not pose unacceptable risks under the current land use.

In March 2018, Rio Tinto began a year-long study to assess monitored natural attenuation as a response action for groundwater. To accomplish this, the company conducted post-removal action (for soil) groundwater monitoring and documented the monitored natural attenuation processes at the site.

On April 22, 2019, the Department received a change-of-use request from the KC Beaton Holding Company LLC to build a Burger King on the property. KC Beaton asked the Department to execute an Acknowledgement of Anticipated Excavation, and provided copies of an identical Acknowledgment and Comfort letter signed by EPA. On June 3, 2019, the Department signed and notarized the Acknowledgement of Anticipated Excavation for the property.

On April 20, 2020, EPA approved Rio Tinto's Report Assessment of Monitored Natural Attenuation. The report concludes that natural attenuation processes are present, and that monitored natural attenuation is an effective action to address residual arsenic in the groundwater. Rio Tinto completed a draft final Feasibility Study Report dated July 10, 2020, which EPA approved, that evaluated various groundwater cleanup alternatives.

On April 13, 2022, the Department conducted the Fiscal Year 2022 annual inspection during which inspectors noted nothing of significance.

In June 2022, EPA published a Proposed Plan which discussed all of the alternatives presented in the draft final Feasibility Study Report, and identified EPA's preferred alternative as In-situ Immobilization Using

Permeable Reactive Zones (PRZs). This alternative includes the use of an innovative technology called redox manipulation to immobilize arsenic in groundwater. EPA estimates it will take four years to construct this remedy, and is uncertain of how long it will take to attain remedial action objectives. EPA considers this approach to be an interim remedy that will allow time to evaluate the long-term effectiveness and permanence of implementing PRZs. EPA discussed the Proposed Plan during a public meeting at the city of North Kansas City office June 30, 2022. EPA also initiated a public comment period from June 20 through July 20, 2022 to receive comments on the Proposed Plan. EPA will consider public comments prior to releasing an Interim Record of Decision, which will state the chosen remedial option EPA will implement.

General Geologic and Hydrologic Setting:

The Armour Road site is located on an alluvial point bar on the north shore of the Missouri River, characterized by 17 to 22 feet of silty clay interbedded with fine-grained sand and silt lenses. Fine- to medium-grained sand underlies these materials to at least 55 feet deep. This sand interval within the Missouri River alluvial aquifer is saturated from 25 feet deep. Due to the thick alluvial cover, bedrock is not exposed.

The underlying bedrock is of the Pennsylvanian-age Kansas City Group, which is 60 to 85 feet below the ground surface.

Groundwater at the site flows southeast through permeable sand and discharges into the Missouri River. The Missouri River alluvial aquifer is used widely in this area.

Public Drinking Water Advisory:

Five active alluvial public water wells, used by the city of North Kansas City, are located approximately 1.3 miles west of the Armour Road site. Due to a southeast-trending groundwater flow pattern, site contamination likely will not influence these wells. Public drinking water sources used by Kansas City and the city of Gladstone include alluvial wells and a surface water intake, all of which are upstream of the site. The city of Independence uses an alluvial well field located approximately 8 miles downstream along the Missouri River's southern bank. Although this entire region's alluvial wells draw from Missouri River alluvium, no impacts are expected.

Health Assessment:

The primary contaminant of concern at the site is arsenic. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential health effects associated with the contaminant.

The Armour Road site has not impacted nearby alluvial wells, and as long as the institutional controls are in place and active, no impact to existing public water wells is expected.

A Restrictive Covenant placed on the property in 2005 aids in protecting people from remaining residual subsurface soil contamination. Monitoring of the site will continue until the current remediation process is complete.

Based on the available information, this site does not appear to pose a significant public health risk. If subsurface soils are disturbed, exposure to contaminated soils may occur. Groundwater assessment is ongoing. If site-impacted groundwater infiltrates drinking water supplies, adverse health effects may occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Bliss Property — Ellisville

Site Name: Bliss Property – Ellisville

Classification: Class 3

Date of Registry Placement: January 3, 1984

Date of National Priorities List Listing: September 8, 1983

Site Address: 149 Strecker Road,
Ellisville, St. Louis County, MO

Present Property Owner: Jerry Russell
Bliss et al.

Lead Agency: U.S. Environmental
Protective Agency (EPA)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), waste pigments, solvents, oils, and pesticides

Contaminants: TCDD, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals

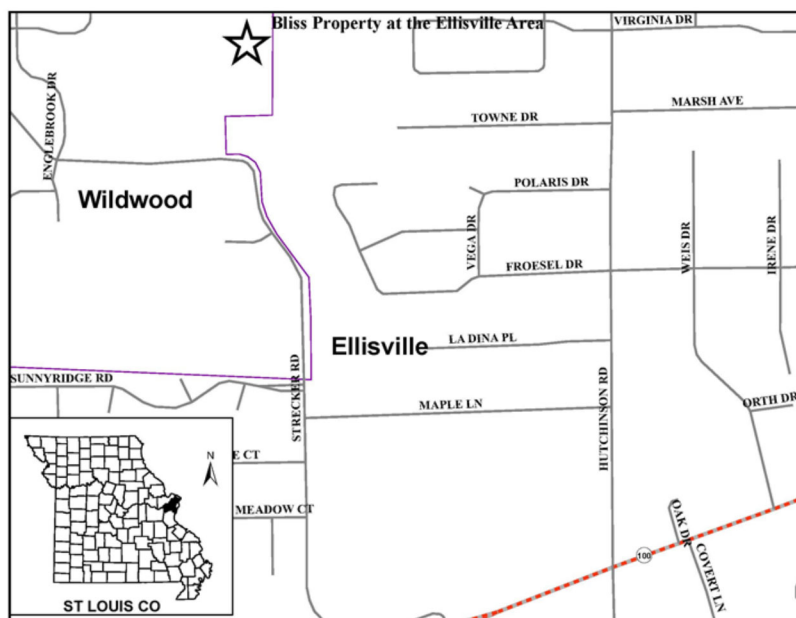
Quantity: In 1996, EPA completed a Removal Action and removed a total of 24,478 tons of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)-contaminated soil, 581 tons of non-TCDD-contaminated soil, and 480 buried drums and other containers of waste. EPA completed a subsequent Removal Action in 2015, removing 1,545 tons of TCDD-contaminated soil from the site. The quantity of waste contaminating groundwater is not determined.

Site Description and Environmental Concern:

The Bliss Property - Ellisville site is a former waste oil transportation and disposal facility in western St. Louis County, located on the north side of Strecker Road. The site covers an area historically affected by waste oil products, industrial waste, and various other chemicals from the transportation, disposal, and recycling activities of Bliss Waste Oil Company. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin), volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), and metals contaminate soil and groundwater at the site.

The privately owned site is approximately 16 acres in size. Current use includes a personal residence and a commercial horse boarding and riding arena operation. The northwest parcel is a vacant grass and wooded area; all owned by Jerry Russell Bliss. Two intermittent unnamed streams flow through the site: one flows northward, roughly parallel to and on the east side of the entrance road, and into the second stream, which flows to the northwest through the site's northwest parcel.

The former waste oil transportation and disposal facility operated from the 1960s to the late 1970s. The site is no longer a waste transportation and disposal facility. Starting in 1978, the business focused only on transporting waste oil. Ultimately, in 1985 the Supreme Court of Missouri canceled the business' license to transport hazardous waste. Prior to 1980, when the Missouri Department of Natural Resources (Department) received reports of illegal dumping of hazardous waste, TCDD-contaminated waste from the waste oil hauling business was disposed of at the site. In addition, Bliss Waste Oil Company disposed of other hazardous waste there, including solvents, pesticides, and oil in bulk quantities. The responsible party disposed of waste in pits or in buried drums, and dumped liquid waste on the ground. In 1983, the U.S.



Environmental Protection Agency (EPA) added the site to the National Priorities List (NPL).

EPA completed a remedial investigation (RI) report in 1983 that documented buried waste-disposal and dioxin-contaminated soil locations at the site. The EPA also conducted additional RI activities in 1997 in order to determine whether disposal of wastes at the site had impacted groundwater at or near the Ellisville subsite with volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCBs), dioxin, or metals. The Department collected shallow groundwater samples at the site from 2006 to 2016, and the analytical results showed VOC concentrations above the EPA screening levels. The EPA will install in 2021-2022 additional bedrock groundwater monitoring wells outside the site boundaries to check whether the contamination has spread off site, and will collect soil vapor samples to evaluate the risk of vapor intrusion (VI).

In June 2021, being concerned with the safe use of this NPL site, the city of Wildwood proposed including the property in a Special Circumstances Overlay Zone (SCOD).

Remedial Actions:

In the 1980s, the Department conducted a number of investigations that confirmed the presence of hazardous materials in drums and disposal pits, and delineated the approximate boundaries of actual or suspected waste disposal locations. In 1983, EPA completed a Remedial Investigation, which identified the following hazardous waste problems: buried drums, tanks, and other debris; buried containerized hazardous wastes; contaminated soils and sediments; and soils and dust contaminated with TCDD.

In April 1986, the Department erected 400 feet of fence to prevent access to the site from the nearby newly developed Quail Woods Park. In 1986, EPA issued the Record of Decision (ROD) for the Bliss-Ellisville site. This ROD formally selected a final remedy for the non-dioxin wastes at the site, and an interim remedy for the dioxin wastes at the site. The selected alternative for buried drums and non-containerized hazardous wastes was off-site disposal at a Resource Conservation and Recovery Act (RCRA)-permitted or interim status facility. The interim remedy for dioxin-contaminated soil and materials involved excavation of the contaminated soils and temporary on-site storage in a building-enclosed container storage facility awaiting the final remedy decision.

The ROD also included operation and maintenance activities to ensure continued effectiveness of the on-site interim storage facility, including maintenance of the security system, maintenance of site run on/runoff controls, leachate sampling and analysis (if necessary), and groundwater monitoring.

In September 1988, EPA issued the ROD for Final Management of Dioxin Contaminated Soil and Final Disposition of Structures and Debris at Times Beach, Missouri, and the Minker/Stout/Romain Creek Site, Missouri (Times Beach ROD). This ROD established that the PRP could transport dioxin-contaminated soils from a group of designated eastern Missouri sites, including the Bliss-Ellisville site, to Times Beach for thermal treatment. In November 1993 and August 1994, EPA collected surface soil and sediment samples from the drainage way and adjacent areas located between the site and the Turnberry Place Subdivision, which is located north and downgradient of the site. EPA conducted this sampling to determine whether severe flooding during summer 1993 had caused migration of TCDD-contaminated materials off site. The samples did not detect TCDD. In 1996, EPA and certain potentially responsible parties (PRP) conducted a Removal Action (RA) at the site, and they sent excavated dioxin-contaminated soil to the Times Beach incinerator. EPA and certain PRPs removed excavated non-dioxin-contaminated soil to either LWD, Inc., landfill or Rollins Environmental Services landfill, both RCRA-permitted landfills.

In 1996, EPA and certain PRPs implemented an RA at the Bliss-Ellisville site comprising the following activities. EPA and certain PRPs removed TCDD-contaminated soil according to the approved health-based action levels of 1 part per billion (ppb)-equivalent level at the surface, and 10 ppb at a depth of 12 inches, except fill areas where the action level was 1 ppb at all depths. In the creek, the TCDD action levels were 1 ppb to 2 feet; depths greater than 2 feet were cleaned up to 10 ppb. Contractors excavated TCDD-contaminated material and transported it to Times Beach for thermal treatment. Off-site commercial RCRA-permitted hazardous waste facilities managed the non-TCDD hazardous wastes. In all, contractors removed 24,478 tons of TCDD-contaminated soil, 581 tons of non-TCDD-contaminated soil, and 480 buried drums and other containers of waste from the site. EPA collected soil samples to confirm that they had achieved

cleanup goals. Once EPA completed cleanup activities, excavated areas were backfilled, re-graded, and seeded.

During fall 1997, EPA installed three shallow groundwater monitoring wells to determine if any of the contaminants had migrated into the local groundwater. EPA sampled the wells on a quarterly basis, from 1997 through 1999, and 2002 through 2003. EPA also sampled Lewis Spring, located about 2.5 miles from the site, to determine if any possible contamination migrated from the site. In June 2006, EPA prepared a summary report of analytical data collected by EPA and the Missouri Department of Health and Senior Services from 1997 through 2006, from the on-site monitoring wells, off-site private wells, and the off-site spring. Several metals and organic compounds exceeded health-based benchmarks in monitoring wells. Private well samples detected trichloroethene in one well in 1985, but not in subsequent samples from that well or in any other downgradient wells. EPA reported low-level detections of organic compounds in samples from the Lewis Spring.

A number of the contaminants exceeded their maximum contaminant levels (MCL). EPA also found low-level detections of organic compounds at an off-site spring, Lewis Spring, which suggested the possibility of contaminant migration from the site. The Department continued sampling of on-site groundwater and the spring from 2006 through 2016. The Department also sampled subsurface soil during that timeframe and measured TCDD, VOCs, and SVOCs above screening levels.

The Department conducted several rounds of groundwater sampling at the site and Lewis Spring from 2006 through 2016. During this time, the Department installed four additional groundwater monitoring wells, which were included in the sampling events. In September 2008, the Department performed sampling of subsurface soils on the Bliss property. The purpose of the sampling was twofold: to investigate the overburden soils to identify source material, if present, that could be contributing to the groundwater contamination beneath the Bliss property; and, to decide if the PRP needed to conduct further investigation or action.

The Department analyzed all samples for VOCs, SVOCs, and metals, and analyzed three samples for TCDD and furans. From 2009 through 2016, the Department conducted several rounds of soil gas sampling at three locations between the site and the nearest residences of the Turnberry Place Subdivision. The Department conducted soil gas sampling to evaluate the potential for vapor intrusion to affect homes in the area. In 2011, the Department installed three soil gas monitoring wells as part of the investigation.

In May 2019, The Department compiled and evaluated results of its groundwater monitoring well, soil gas, subsurface soil, and spring sampling events, and completed the Bliss 2006-2016 Sampling Report. The report documents that shallow groundwater samples detected metals, VOCs, and SVOCs at concentrations above health-based screening levels. Soil gas samples did not detect site-related contaminants of concern. Subsurface soil samples contained TCDD, VOCs, and SVOCs above screening levels, with tetrachloroethene measured above health-based screening levels in one Lewis Spring sample. Due to challenges posed by laboratory detection levels, it is inconclusive whether TCDD is in groundwater and surface water samples at concentrations above health-based screening levels.

The report includes the following recommendations: evaluate the sampling investigation results by EPA and state risk assessors to determine the current risk posed by the affected portions of the Bliss property; continue to perform shallow groundwater monitoring; consider assessing the potential for vapor intrusion into the residential trailer on the Bliss property; and, execute an environmental covenant to restrict the use of shallow groundwater at the site, along with requiring vapor intrusion assessment prior to constructing buildings in the site's northern portions.

Following a series of investigations in 2014, EPA conducted a Removal Action on an approximately 1-acre area encompassing the northwest portion of the Bliss property and a portion of the west-bounding Strecker Forest property. During these investigations, contractors removed and appropriately disposed of 1,545 tons of TCDD-contaminated soil. As of March 2015, two environmental covenants establishing land-use restrictions for these areas are on file with the St. Louis County Recorder of Deeds. The restrictions include no occupied residential land use (residential subdivision preservation or common area is acceptable) and no disturbance of soil without Department permission.

In July 2020, EPA completed a Revised Final Baseline Human Health Risk Assessment. The conclusions focus on the detected chemicals at the site associated with most of the cancer and non-cancer risk. The

conclusions list potentially completed exposure pathways that EPA evaluated for the site. EPA intends to perform further sampling at the site.

EPA will install four additional bedrock groundwater monitoring wells between the site and Lewis Spring, and also sample soil gas for VOC monitoring in the summer and fall of 2022.

The Department conducted the Fiscal Year 2022 annual inspection on May 3, 2022, and noted that the owner had removed the trailer that was present on the property.

General Geologic and Hydrologic Setting:

The site is located in an upland wooded area with steep hillslopes descending to a low-lying, intermittent tributary of Caulks Creek. The upland soils are composed of silty clay loess overlying cherty residuum derived from the weathering of bedrock. The loess is up to 10 feet thick and has moderate to low permeability. The residuum is moderately to highly permeable. Soil material along the valley near the horse arena is composed of gray, silty clay and clayey silt.

Bedrock at the site consists of the Mississippian-age Burlington Limestone Formation. This formation contains solution-enlarged openings, which provide avenues of rapid fluid transport to groundwater.

Under normal flow conditions, the surface drainage upstream of the former disposal site area is gaining; that is, water flowing on the surface tends to remain on the surface. This is due to the presence of the relatively low-permeability loess soil that underlies that portion of the property. However, near the former disposal site where the loess is absent, surface water is lost to the subsurface via the relatively high-permeability cherty residuum and weathered bedrock present beneath that portion of the site. Water tracing studies conducted in 1992 and 1997 indicate that water flowing into the subsurface near the former disposal site is discharged at Lewis Spring, located along Caulks Creek downstream of the site. During high surface-flow conditions, such as immediately following heavy precipitation events, some flow remains in the surface stream throughout its extent on site and further downstream.

Due to the presence of losing stream conditions immediately downgradient of the former dump site, groundwater quality may be adversely impacted. However, channelization of subsurface flow from the losing stream segment likely prevents widespread groundwater contamination.

Public Drinking Water Advisory:

No public water sources are located near this site. A small business uses an active public water well approximately 2 miles west-southwest of the site, but groundwater generally flows north toward the Missouri River. Based on this information, the Department does not expect impacts to public water sources.

Health Assessment:

TCDD is the main chemical of concern at this site. VOCs are present in the on-site monitoring wells. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

VOCs contaminate shallow groundwater; therefore, the route of remaining potential exposure is through groundwater. Missouri Department of Health and Senior Services sampled private wells downgradient from the site from 1984 to 2013 and have not found any private wells contaminated with site-related VOCs.

Based on available information, this site poses a potential health risk due to contaminated groundwater. Investigation into the potential for vapor intrusion is ongoing.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Chevron Chemical Company

Site Name: Chevron Chemical Company

Classification: Class 3

Date of Registry Placement: January 6, 1984

Site Address: 2497 Adie Road, Maryland Heights, St. Louis County, MO

Present Property Owner: Chevron Chemical Company

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Organochlorine pesticides, herbicides, carbamate fungicide, volatile organic compounds (VOCs), and arsenic

Quantity: Not determined

Site Description and Environmental Concern:

The Chevron Chemical Company site is a former pesticide, herbicide, fungicide, and fertilizer formulation plant operated by the Ortho-Chevron Chemical Company between 1948 and 1994. Subsurface soil and groundwater at the site are contaminated with organochlorine pesticides, herbicides, fungicides, arsenic, and volatile organic compounds (VOCs), including trichloroethene (TCE), xylene, and chlorobenzene.

The site is located in a light commercial/industrial corridor of Maryland Heights, bordering a residential area. Fewer than 25 residences are located within a 0.5-mile radius of the site. The site is a privately-owned 10-acre parcel of land that includes a 112,000-square-foot former manufacturing facility and several other buildings. The entire parcel is fenced and gated. The site no longer operates as a pesticide, herbicide, fungicide, or fertilizer formulation plant. As of May 2021, Chevron is not using any of the buildings.

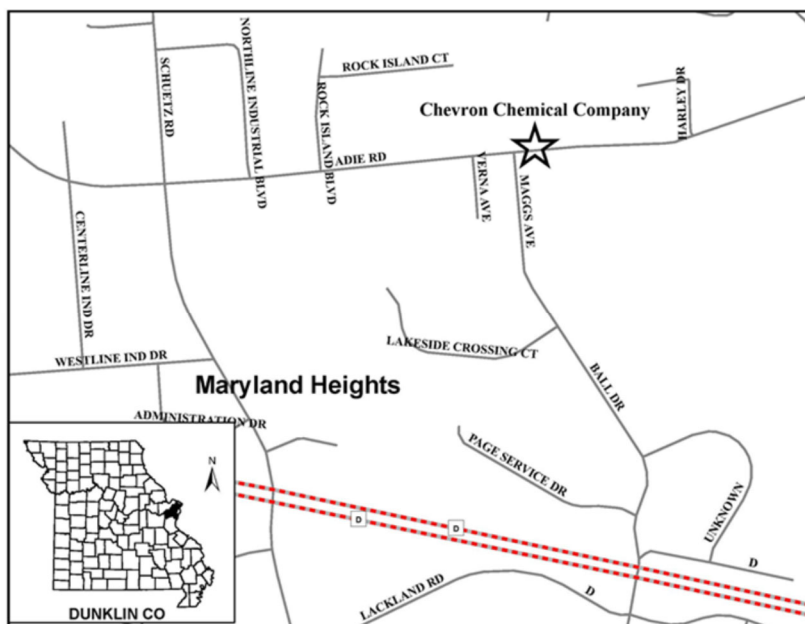
The site's topography is generally flat with a slight east-to-west slope. It is paved with a combination of concrete and asphalt. The site drains to the west toward the Missouri River. Groundwater beneath the site is shallow and flows to the west-northwest, although there is uncertainty regarding groundwater flow direction in the property's southwest quadrant.

Following a 1952 fire at the facility, Chevron buried debris and a variety of chemicals in unlined pits on the property. Between 1957 and 1970, the company also buried up to 2,000 pounds of the carbamate fungicide Maneb and arsenic-containing wastes on the property. Chevron subsequently constructed buildings over a portion of the burial area. TCE and other VOCs are present in shallow groundwater under the site's central and southwest areas, and in soil and groundwater off site to the south.

Elevated organochlorine pesticide and arsenic contaminant concentrations in the soil and groundwater remain at the site. VOC concentrations, specifically TCE, xylene, and chlorobenzene, are elevated in groundwater.

Remedial Actions:

In the 1980s and early 1990s, Chevron consultants conducted several site characterization investigations.



Chevron collected soil samples from multiple depths at 56 boring locations on the Chevron parcel, and on some adjacent parcels. Groundwater monitoring began at the site in 1981. Currently, 29 bedrock-monitoring wells are associated with the site, including several located off the Chevron property.

In 1987, the U.S. Environmental Protection Agency (EPA) and Chevron entered an Administrative Consent Agreement and Consent Order. In 1992, under EPA oversight, Chevron capped unpaved areas of soil contamination north of the buildings and installed a stormwater collection and detention system. When manufacturing operations ceased at the facility in 1994, Chevron removed pesticide-handling equipment and storage containers, and decontaminated building surfaces under EPA oversight. Asphalt, concrete, or building structures cover the property. Chevron occasionally leases some of the property to various commercial interests.

In 2008, EPA referred lead oversight to the Missouri Department of Natural Resources (Department), recommending that Chevron continue to monitor groundwater annually. Currently, 16 of the 29 monitoring wells are included in an ongoing annual monitoring program. Site contaminants include organochlorine pesticides, arsenic, and VOCs.

Over time, groundwater contaminant concentrations have decreased at many of the wells. However, annual monitoring showed increases in organochlorine pesticides and VOCs at some downgradient well locations to the north, northwest, and south. The maximum organochlorine pesticide concentration found in soil on the site is over 7,000 parts per billion (ppb). The maximum organochlorine pesticide concentration found in groundwater below the site is 6,480 ppb. The maximum arsenic concentration found in on-site soil is over 1,000 parts per million (ppm). The maximum arsenic concentration found in groundwater below the site is 66 ppm. The maximum VOC concentrations in groundwater below the site include TCE at 9,470 ppb, xylene at 28,600 ppb, and chlorobenzene at 1,200 ppb. Groundwater monitoring indicates that organochlorine pesticides, herbicides, arsenic, and VOCs, including TCE, have migrated in groundwater off site to the north, south, and west. Of particular concern is the presence of TCE in two wells located on the southern parcel boundary adjacent to Adie Road. Concentrations in that location have increased from a maximum of 2,000 ppb when first measured in 1991 to 8,820 ppb in 2020.

In 2014, due to uncertainty about the TCE groundwater contamination's source and concerns about potential vapor intrusion, the Department conducted a Pre-Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Screening Investigation under the site name Maryland Heights TCE Site. The investigation included an assessment of other nearby known TCE contamination sources and sampling at existing monitoring wells on a property 0.5 mile southeast of the site. The Department did not identify any upgradient TCE contamination sources.

In 2016, the Department initiated a CERCLA Site Inspection (SI) to investigate the TCE contamination further. In 2018, as part of the SI, the Department sampled a commercial property across Adie Road from the Chevron well with the highest TCE concentrations. This sampling detected TCE in soil gas at 64,000 micrograms/cubic meter ($\mu\text{g}/\text{m}^3$) at a depth of 5 feet beneath the parking lot and about 20 feet from the building. This result is significantly above TCE's soil gas screening level of 100 $\mu\text{g}/\text{m}^3$. The property owner denied access for additional sampling and did not respond to subsequent letters or phone calls. The Department also collected sub-slab vapor samples beneath a manufacturing facility northwest of the Chevron property; results were below screening levels. Soil gas and groundwater data collected at other parcels near the Chevron site as part of the SI did not indicate potential vapor intrusion concerns. In May 2021, the Department finalized the Site Inspection report, which recommended Chevron conduct additional vapor intrusion assessment. The Department is negotiating with Chevron to conduct this work.

Part of the site remedy included maintenance of an on-site surface cap to prevent exposure to remaining contaminants in the subsurface. During the 2019 annual inspection, Department staff observed a surface seep flowing up through the asphalt cap between the buildings and Adie Road, flowing across the pavement and discharging to the storm water drain. The Department notified Chevron of the seep and asked the company to take measures to address it. During the 2020 annual inspection, although not actively flowing, there was visual evidence that the surface seep still was present.

On May 17, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which the inspector noted several cracks in the pavement.

In July 2022, the Department referred the Maryland Heights TCE site to EPA for further evaluation.

General Geologic and Hydrologic Setting:

Twenty to 30 feet of loess, or wind-deposited, clayey silt, over Pennsylvanian shale or residual clay underlie the site. A limestone unit that is part of the uppermost aquifer lies below the shale or clay at a depth of about 30 to 70 feet.

The confining unit at the base of this aquifer is the Maquoketa Shale at a depth of several hundred feet. Water from deeper horizons of the limestone aquifer may be too saline and considered non-potable. The shallow part of the bedrock aquifer probably produces good-quality water; however, yields may be low. This area does not use groundwater due to the presence of surface public water supplies.

Perched water is present in the loess, but yields are too low to consider this an aquifer. Contaminants at the site affect the perched groundwater. Due to the presence of low-permeability material beneath the loess, the water within the loess likely discharges to the surface or through buried sewer lines downgradient of the site.

The site is located in the Fee Fee Creek watershed. An on-site lined detention pond collects surface water from the site, which discharges through the city storm water system into Fee Fee Creek. Fee Fee Creek ultimately drains into the Missouri River approximately 5 miles northwest of the site.

Public Drinking Water Advisory:

Missouri American Water – St. Louis County/St. Charles County serves drinking water to this region, drawing water from the Missouri and Meramec rivers. No site-related impacts are expected.

Health Assessment:

The primary contaminants of concern at the site are: arsenic; various organochlorine pesticides and herbicides, including aldrin, 2,4-dichlorophenoxyacetic acid, dieldrin, lindane, chlordane, 4,4'-dichlorodiphenyltrichloroethane, and toxaphene; and, VOCs, including TCE, chlorobenzene, and xylenes. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Potential human exposure through contact with soils and surface water is low, because contaminated areas are capped and paved by asphalt, concrete, or permanent structures. Perimeter fencing restricts access to the site. Soil gas samples collected by the Department in 2018 indicate that intrusion of TCE vapors is a potential concern for the building on a parcel across Adie Road from the site. However, property owners denied the Department access to the building to conduct additional sampling. Data collected at other parcels around the Chevron site as part of the Department's 2018 SI did not identify other vapor intrusion concerns.

Risk of exposure at this site is minimal, as long as the cap remains intact. Maintaining the existing asphalt cap will eliminate potential direct exposure to contaminated soils. If site conditions change such that exposure to contaminated soil occurs, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Denney Farm (Capped Trench)

Site Name: Denney Farm (Capped Trench)

Classification: Class 3

Date of Registry Placement: January 24, 1992

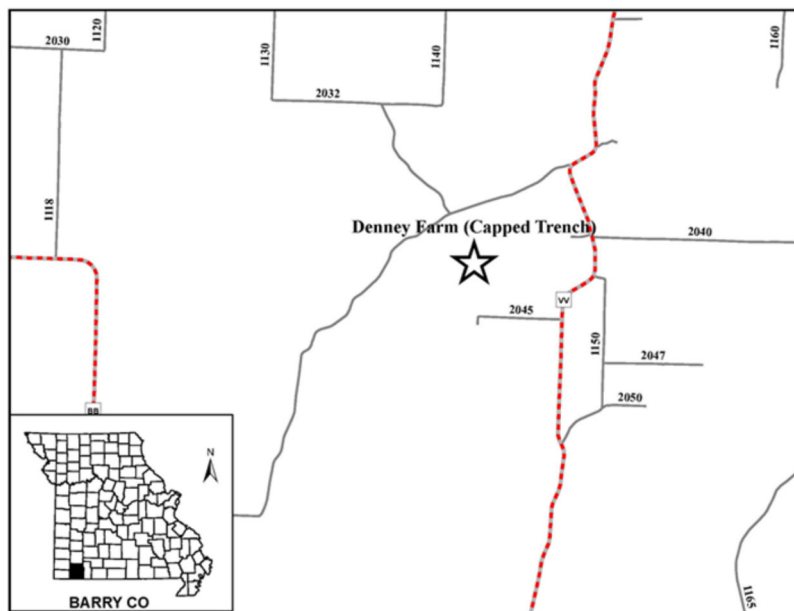
Site Address: Seven miles south of Verona, Barry County, West of Highway VV, Part of NW 1/4, Sec. 20, T25N, R26W, McDowell Quadrangle

Present Property Owners: James Denney

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin)

Quantity: Not determined



Site Description and Environmental Concern:

The Denny Farm site is the location where, in 1971, the property owner accepted and buried approximately 90 drums of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin) -contaminated waste in a shallow trench. As a result, TCDD is present in soil. When excavated, the trench on the privately-owned property measured roughly 12 feet by 61 feet by 5 feet deep. Syntex Agribusiness, Inc. (Syntex), the responsible party of the TCDD-containing drums disposed of at Denny Farm, backfilled the trench with compacted clay and capped it.

The total site area as listed in the registry is 1.5 acres, including the capped trench and the uncontaminated buffer. The site is located in a previously used cattle pasture that is vegetated and marked with permanent boundary monuments. A field and several acres of forest surround the trench. To restrict access, a perimeter fence surrounds the site, and a locked chain crosses the access road.

Surface erosion leading to cap deterioration is a long-term concern. Due to a lack of continual site maintenance over the years, clusters of trees, animal burrow holes, brambly/patchy vegetative growth, and the beginnings of surface soil erosion could create environmental problems associated with the cap's integrity. The public expressed concern about site maintenance at the Denney Farm during a 2019 U.S. Environmental Protection Agency (EPA) public availability meeting for the Syntex Verona Superfund site.

Remedial Actions:

In 1980, after an anonymous tip, EPA conducted a site inspection and found partially buried leaking drums, drum fragments, and contaminated soil. In September 1980, Syntex entered into a Consent Decree with EPA to perform cleanup work at the Denney Farm site. Syntex and EPA conducted several response actions to address the contamination. In 1981, Syntex excavated the drums and soil in the trench and an additional 5 to 12 inches of soil from the trench's sides and bottom. Syntex sampled the soil in the trench bottom and sidewalls and found that dioxin concentrations generally decreased outward from the sidewall and downward from the trench bottom. At most, an estimated 0.38 ounces of dioxin remained at depth. EPA determined that additional excavation was not necessary, since the remaining dioxin is immobile and a maintained cap would prevent soil exposure from occurring. EPA destroyed the TCDD-contaminated soil and drummed waste on site via thermal treatment.

The remaining TCDD-contaminated soil in the trench averaged approximately 10 parts per billion (ppb) TCDD, with a maximum level of 530 ppb. EPA based the decision to backfill the trench on information provided by geologic and waste-isolation professionals. The trench's sides and bottom were composed of a very dense and impermeable soil. The Missouri Department of Natural Resources (Department) found no joints or openings capable of transmitting water from the surface to underlying bedrock. Finally, the Department determined the remaining TCDD to be immobile and unable to migrate, unless it were transported by surface water percolating through the trench. Syntex backfilled the trench with compacted low-permeability clay and installed an impermeable plastic cap to prevent surface water percolation into the trench. Syntex then placed sod over the impermeable cap's topsoil to prevent erosion. Syntex completed all capping activities in December 1981.

Based on local groundwater data, the site is approximately 140 feet above Calton Creek, which reflects the groundwater table level in the creek's valley. The site is well above the local groundwater level and should not directly affect the groundwater. In 1980, EPA assessed groundwater quality in the area around Denney Farm by collecting 115 samples from 14 nearby domestic wells and a spring. None of the sample results indicated dioxin's presence.

In 2019, EPA held two public meetings where citizens expressed concern about recent site maintenance issues at Denney Farm. As noted in annual inspections starting in 2018, a lack of adequate maintenance has created issues with tree growth and animal burrows in the trench cap, which could potentially compromise its integrity. Nearby residents with private drinking water wells were concerned about potential contamination migration. As a result, in December 2019 and February 2020, EPA sampled 18 domestic wells near Denney Farm, 15 of which were within 1 mile of the site. The water samples were analyzed for semi-volatile organic compounds including 1,4-dioxane, volatile organic compounds, and dioxins. EPA determined that site-related contaminants are not affecting the private wells above relevant drinking water standards.

Over the last several years, clusters of black locust trees and animal burrows have caused breaches in the trench cap's integrity, which could create the potential for exposure to waste left in place. In February 2021, EPA and the Department requested Syntex to conduct needed repairs and maintenance on the site, and to prepare to take responsibility for long-term operation and maintenance. EPA requested Syntex to enter into an Administrative Order on Consent (AOC) with the Department to perform this work. The Department is requiring Syntex to perform the needed repairs to remove trees, locate and fill in animal burrows, and re-establish a viable vegetative cover on the cap. As part of the Operation and Maintenance Plan, Syntex would conduct annual site inspections to verify the site's condition and trench cap's integrity. AOC negotiations are ongoing.

On June 28, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which the inspector noted that trees still are present and wildlife has disturbed the soil cap. The vegetation appeared mowed in places where a brush hog could maneuver.

General Geologic and Hydrologic Settings:

Valleys and ridges characterize the topography around the site. The major streams have broad, flat, deeply-incised valleys, and smaller tributaries dissect the plateau surface, resulting in rugged terrain. The valley of Calton Creek truncates a wooded northwest-trending ridge where the site sits. The site itself is nearly flat. Surface runoff drains to the northeast or southwest to small tributaries of Calton Creek. Although the section of Calton Creek nearest the site is gaining, the upstream and downstream reaches, as well as most of the creek's tributaries, lose significant portions of their flow to the subsurface. Due to the highly permeable nature of the surface materials and bedrock, surface runoff around the site rarely occurs.

Throughout the site, surficial materials consist of 0 to 6 feet of windblown silt (loess). Across portions of the site, a fragipan (densely packed layer of chert fragments and clay) may exist at a depth of about 3 feet. The fragipan typically acts as a barrier to downward water migration, causing seasonal or temporary perched water conditions. Eight to 33 feet of red, hard, clayey silt underlies the loess. This silt ranges from pure clay to sandy clay with isolated chert fragments possibly derived from the weathered bedrock. The clayey silt grades into a weathered bedrock horizon of 2.7 to 5 feet of weathered white chert boulders with red clay seams. The bedrock below the weathered bedrock horizon consists of a jointed hard, dense, white to light gray waxy chert. The jointed bedrock grades into the Reeds Spring Formation, a competent limestone that slopes east from bedrock high at the site's northwest corner. The Reeds Spring Formation is not weathered and contains no karstic development. The Reeds Spring Formation, along with the underlying Pierson

Formation, represents the shallow aquifer in this area. Remnants of a Pennsylvanian-age sandstone layer are present near the site.

Due to limited yields, the shallow aquifer primarily serves individual households. Wells requiring high yields, such as community wells, must tap the deep aquifer, which is composed of Cambrian- and Ordovician-age carbonates and sandstones. A confining unit at about 300 feet deep effectively separates the deep aquifer from the shallow aquifer.

Public Drinking Water Advisory:

The closest public water well to this site is more than 4 miles away, and no site-related impacts are expected.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Based on the available information, this site does not appear to present a significant health risk, as long as the cap's integrity is reestablished and maintained. If use of this site were to change, or excavation or surface grading were to expose contaminated soil, exposure to TCDD-contaminated soil could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Independence FMGP #1

Site Name: Independence FMGP #1

Classification: Class 3

Date of Registry Placement: November 28, 2000

Site Address: Northwest of the intersection of West Pacific Avenue and S. River Boulevard., Independence, Jackson County, Mo.

Present Property Owners: Reorganized Church of Jesus Christ of Latter Day Saints (RLDS)

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Coal tar, which contains volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs)

Quantity: Not determined

Site Description and Environmental Concern:

The Independence FMGP site is a former manufactured gas plant (FMGP) with a historic release of volatile organic compounds (VOCs) and carcinogenic PAHs at concentrations greater than health-based screening levels in the surface and subsurface soils. The site operated as an FMGP from approximately 1885 through 1926.

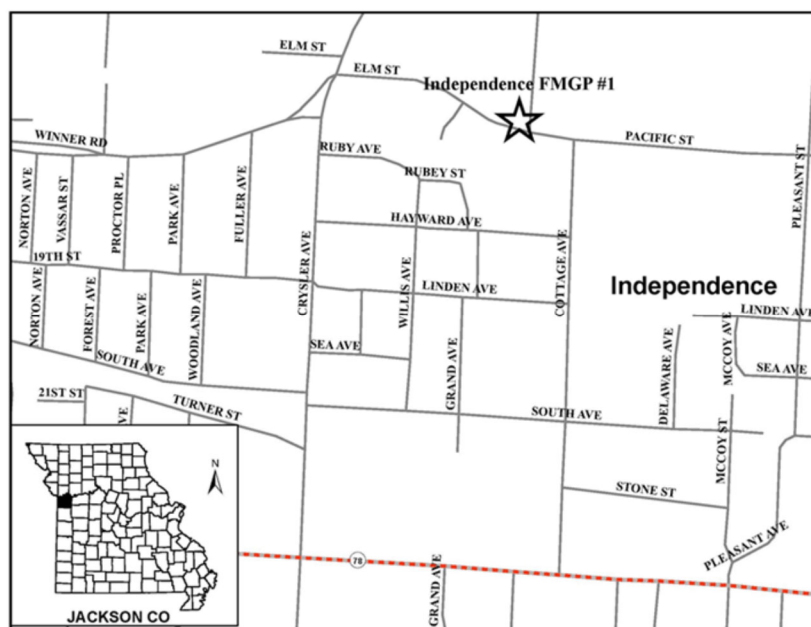
The site is located in an area of residential, commercial, and light industrial land uses. The Reorganized Church of Jesus Christ of Latter Day Saints (RLDS) owns the property where gas plant operations occurred. In addition to the RLDS property, several of the plant operations buildings were located on land that lies beneath what is now West Pacific Avenue. The site is located within the drainage basin along the southeast edge of the RLDS Auditorium parking area and extends beneath West Pacific Avenue. Currently, healthy vegetation covers the entire basin area, and access is not restricted. There are no visual remains of the former gas plant structures on site.

The FMGP structures depicted on historic Sanborn maps included three gas holders, retort houses, and purifiers. No information is available regarding operations after the manufactured gas plant closed circa 1926 through the early 1990s, when the RLDS built the drainage basin.

In March 2000, the Missouri Department of Natural Resources (Department) collected surface and subsurface soil samples from the former manufactured gas plant's approximate location. The coal tar remaining in the subsurface soil may pose human health risks if the contaminated areas are ever excavated or accidentally uncovered.

Remedial Action:

On May 12, 2000, the Department completed a pre-Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site screening report. Coal tar, a byproduct of the gas manufacturing process, was determined to be the primary waste of concern.



As long as institutional controls remain in place, adverse impacts are not anticipated from the former gas plant site. The majority of contamination is located 6 to 7 feet below the ground's surface and does not pose a significant air or soil exposure risk. The site is either paved with asphalt or serves as a drainage ditch.

On May 18, 2022, the Department conducted the Fiscal Year 2022 annual inspection and reported no significant changes.

General Geologic and Hydrologic Setting:

The site is located on the rolling, loess-covered hills immediately south of the Missouri River in the Kansas City region. It lies outside a 50-year flood plain. Loess-derived surface soils at the site are composed of silt loam to silty-clay with a moderate permeability. Roughly 5 to 24 feet of loess and glacial till overlie the local bedrock.

Kansas City Group Pennsylvanian-age bedrock at the site consists of 450 feet of 1- to 20-foot-thick beds of alternating limestone and shale with infrequent thin coal beds. Surface water infiltrates the shallow limestone layers, which form small intermittent springs on the hills.

The Kansas City region rarely uses deep groundwater for drinking purposes due to high mineral content. Groundwater in formations near the site is typically located at depths of 24 to 55 feet below the surface.

Public Drinking Water Advisory:

The city of Independence obtains groundwater from Missouri River alluvial deposits located approximately 5 miles north-northeast of the site. The Department does not expect impacts to Independence's well field, and no other public water sources are located near the site.

Health Assessment:

The contaminant of concern at this site is coal tar, which contains VOCs and SVOCs, including PAHs. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Most site contamination is located in subsurface soils and not expected to pose an exposure risk. Furthermore, no residents or workers are located on the site, and the potential for on-site exposure and off-site migration is minimal. Disturbance of the subsurface soil would increase the chance for public exposure to the buried hazardous wastes. No significant health risk exists on site, unless the subsurface soils are disturbed.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Lake Lotawana Sportsmen's Club

Site Name: Lake Lotawana Sportsmen's Club

Classification: Class 3

Date of Registry Placement: July 31, 2001

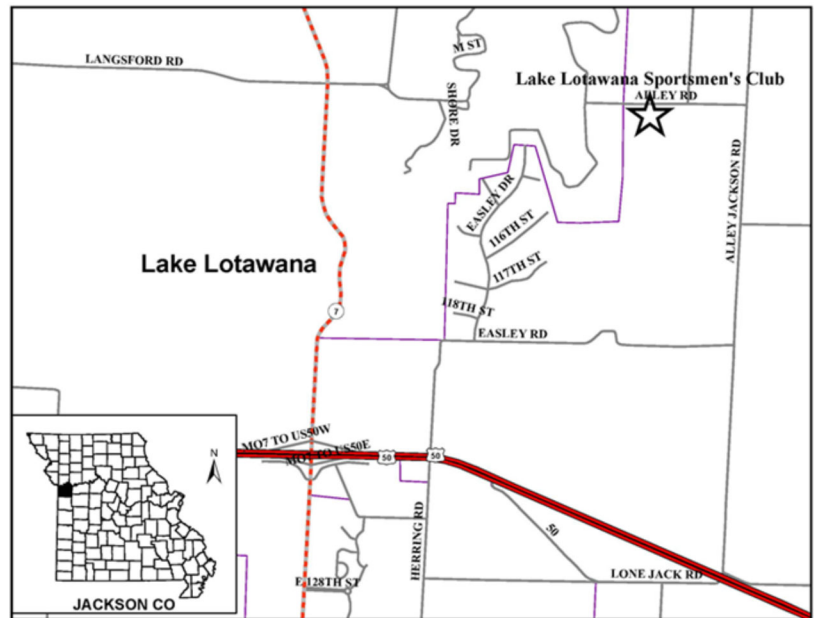
Site Address: 29709 Alley Road, Lake Lotawana, Jackson County, MO

Present Property Owner: Lake Lotawana Sportsmen's Club, Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Lead

Quantity: Not determined



Site Description and Environmental Concern:

The Lake Lotawana Sportsmen's Club site is an active, private sport club that has operated as a recreational small arms firing range since 1977 pursuant to a special-use permit from Jackson County. The site is approximately 60 acres in size, has unrestricted access, and residences are located nearby. A formal complaint registered with the Department regarding possible lead contamination prompted an investigation in September 2000. Lead, associated with the firing range's operation, is the primary waste of concern.

A 2001 Department investigation determined surface soils contained elevated concentrations of lead. The Department detected low concentrations of lead in downgradient sediment samples collected from an on-site intermittent stream, indicating that some lead may be migrating off site. However, the Department had not documented significant accumulation of lead in the on-site intermittent stream in previous sampling.

Remedial Action:

The 2001 Site Screening investigation concluded that under current site conditions, no significant exposure risk is present through the soil pathway or surface water pathway. Access to the contaminated soil is limited as long as the site remains a firing range. Soil was sampled at a private residence located immediately downwind north of the site, and lead was measured in the yard at 20 ppm, far below the U.S. Environmental Protection Agency's (EPA) residential cleanup level for lead of 400 ppm. The Department may determine that further Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation is necessary if the firing range closes and the property use changes.

In June 2013, the Department reopened a site investigation in response to a citizen's concerns that lead could have migrated off the firing ranges into nearby Lake Lotawana via two intermittent streams that converged on the site during a flooding event. Multiple plastic shotgun waddings washed downstream into Lake Lotawana. Past registry annual site inspections noted that flooding has caused erosion in the form of a big gully in the trap-shooting range area where the debris lands.

In July 2013, as part of a Site Inspection investigation, the Department conducted surface water and sediment sampling of the intermittent creeks that receive drainage from the shooting range. The Department documented a release of hazardous substances, specifically lead and polycyclic aromatic hydrocarbons (PAHs), in the creek sediment on club property and downstream, off club property, at the creek outflow to Lake Lotawana. The lead levels in the creek sediment exceeded environmental sediment quality standards

but not residential health-based benchmarks. PAH levels exceeded both environmental sediment quality standards and the EPA's residential and industrial health-based benchmarks. The PAH contamination is associated with the clay targets used at shooting ranges. Surface water samples from the creek do not show any PAH contamination, and the relatively low levels of dissolved lead in the water are below Missouri Water Quality Standards. Further, fish tissue samples collected from Lake Lotawana in August 2013 did not show any lead contamination at levels of health concern. Only two of nine samples contained any detectable levels of lead – both more than 10 times below the Missouri Fish Fillet Advisory Concentration.

On Nov. 17, 2017, the gun club received a special-use permit from Jackson County to conduct a lead reclamation project. The project involved scraping and grubbing the topsoil, which contained lead pellets distributed from the club's firearms target practicing activities, sifting to separate the shot pellets from the soil, and replacing soil.

In 2018, the gun club's contractor completed the lead reclamation project, during which it processed approximately 2,600 cubic yards of soil and removed 656,000 pounds of salvage lead, which was sent for recycling. In October 2019, the gun club submitted the lead reclamation report to the Department.

In November 2019, the Department conducted a site visit to verify that the gun club had put erosion controls in place according to their approved 2016 Storm Water Pollution Prevention Plan (SWPPP). The erosion controls were designed to control the gun wads from leaving the property. The inspector noted that the gun club had erected fences to catch the wads as they flowed down the range during high-rain events. There was a stream at the bottom of the hill and a tributary to Lake Lotawana approximately 0.25 mile from the shooting range. The gun club representative stated that they had looked at the tributary but had never seen any wads in the tributary. The gun club representative said they were working with the Department of Conservation to terrace the land to keep the wads from flowing down the hill and to help stop erosion as a more permanent solution. The inspector did not observe any wads in the lake or tributary of the lake, or any wads close to the stream or in the stream.

In 2018, the Department requested the Missouri Department of Health and Senior Services (DHSS) to review the 2015 Site Inspection report to determine whether further sampling of sediment from the intermittent creek on the neighboring property and in Lake Lotawana is necessary. DHSS believes there is no current elevated health risk at the site to justify additional sampling.

On May 18, 2022, the Department conducted the FY22 annual inspection, during which inspectors identified a well-maintained site and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located in the Osage Plains subdivision of the Central Lowlands physiographic province, just south of the inferred southern limit of glaciation. This area has narrow, thin loess-covered ridges composed of moderately permeable silt and silty clay, with low permeable clay increasing with depth, and a thickness of 10 to 20 feet. Drainage ways dissect these ridges. Below the loess-covered ridge, the slope is steeper, and the loess has been eroded, exposing residual soil 5 feet thick or less, composed of more permeable stony, silty clay.

Pennsylvanian-age bedrock of lower Kansas City Group consists of cyclic deposits of shale and limestone with low overall permeability. Groundwater, which accumulates on Pennsylvanian-age shales, is pumped from shallow wells. The depth to groundwater is about 30 to 40 feet below ground surface. A perched seasonal water table of 2 to 3 feet has been reported for soils on the steeper side slopes. Local shallow groundwater flow is expected to mimic topography and flow to the southwest toward Lake Lotawana. Regional groundwater flow is expected to be to the north toward the Missouri River. The recharge to the aquifer in this area is very limited, only from direct precipitation infiltration. The Kansas City Group is underlain by thick shale of the Pleasanton Group, which is considered non-water-bearing and a barrier to deeper, highly mineralized water-bearing units.

Surface water flows south to an intermittent stream that enters Lake Lotawana, which discharges to the West Fork of Sni-A-Bar Creek. Sni-A-Bar Creek enters the Missouri River in western Lafayette County.

The potential for groundwater contamination is low to moderate in this area due to low permeability of the

underlying bedrock. Surface water is much more susceptible to contamination than the groundwater system.

Public Drinking Water Advisory:

The nearest public water source to this site is over 8 miles away. No site-related impacts are expected.

Health Assessment:

The chemical of concern at this site is lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The primary public health concern is human exposure from ingestion and inhalation of lead by Sportsmen's Club users. Club members may incidentally ingest or inhale lead-contaminated dust during shooting activities at the site. As with any hobby or recreational activity involving lead, DHSS recommends hand washing before eating or drinking, as well as removing and cleaning clothes and shoes to prevent tracking lead inside the home.

DHSS reviewed the Site Inspection, fish samples collected from the lake, and the lead reclamation report. Based on the results of the fish tissue sampling, there is no public health concern due to lead from consuming fish from Lake Lotawana. Erosion control efforts on site have reduced any possible off-site migration of lead from site activities, further reducing any possible health concerns related to Lake Lotawana. Sampling of sediment and surface water from the intermittent creek on the neighboring property and in Lake Lotawana contained lead below levels of health concern and site work is expected to have reduced lead levels further. Based on the possibility of ingestion or inhalation of fugitive dust associated with gun range use, this site poses a low potential public health risk for Sportsmen's Club users.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Nufarm

Site Name: Nufarm

Classification: Class 3

Date of Registry Placement: August 3, 1998

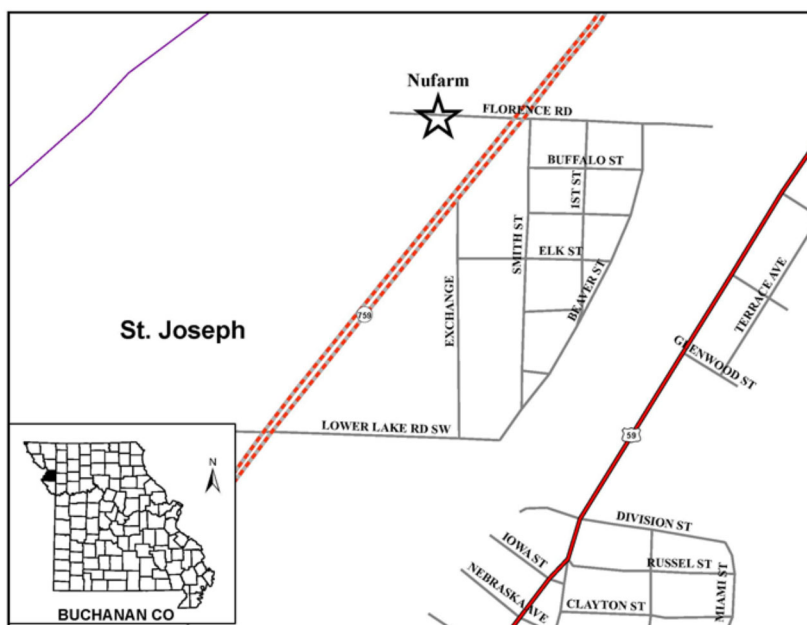
Site Address: 317 Florence Road, St. Joseph, Buchanan County, MO

Present Property Owners: HPI Products Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,4,5-TP (Silvex)

Quantity: Not determined



Site Description and Environmental Concern:

The Nufarm site is a former herbicide-blending and metalworking site in St. Joseph. As a result of past herbicide blending activities and spills during loading and unloading rail cars, on-site soils have been contaminated with 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin) and 2,4,5-TP (Silvex).

The 2.5-acre Nufarm site is a privately owned property, located in an industrial area within 1 mile of residential neighborhoods. Amchem blended herbicides on-site using the active ingredients 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4-trichlorophenoxyacetic acid (2,4,5-T) until 1975. Union Carbide then purchased the property and began blending other herbicides soon thereafter. In 1986, Rhone-Poulenc bought the herbicide-formulation facility. The company acquired only the 2.5-acres of the property containing the facility, and Union Carbide retained the remaining 5.34 vacant acres. In December 1997, Rhone-Poulenc sold the 2.5-acre property and facility to Nufarm, Inc. On Oct. 15, 2001, HPI Products Inc. purchased the plant from Nufarm.

Contamination at the two properties dates from between 1956 and 1975, when Amchem formulated herbicides containing TCDD. The 2.5-acre Nufarm site contains the storage tank and rail area, where railcars transporting chemicals and herbicides were loaded and unloaded by Amchem personnel.

In 1985, samples taken by the U.S. Environmental Protection Agency (EPA) show TCDD levels at 7.1 parts per billion (ppb) in the rail area and at 4.5 and 3.4 ppb at the surface in the storage tanks area. At that time, the common cleanup standard for TCDD was 1 ppb at less than 1 foot in depth or 10 ppb at greater than 1 foot. HPI Products, which operates on-site today, capped the TCDD-contaminated soils with clean soil and gravel in 1997, and the site is fenced with a locked gate to prevent trespassers.

The Missouri River is approximately 150 feet from the site and flooding could affect soil cap integrity. Furthermore, environmental contractors have not thoroughly evaluated impacts to on-site groundwater. The cap above the contaminated soils should prevent worker exposure to soils containing TCDD and Silvex. Any excavation projects must take precautions to avoid exposure to any contaminated soils unearthed from below the cap. Residential areas are located less than 0.5 mile to the southeast and less than 1 mile to the north.

Remedial Actions:

In 1988, Pacific Environmental Services collected on-site soil samples for Union Carbide. TCDD was not detected in the railcar area, although 2,4-D was found at low levels. The owners had capped the tank storage area, due to heavy traffic, and that area was not accessible for sampling.

In July 1995, Nufarm initiated a soil characterization study as part of planned repairs to the deteriorated rail siding. One sample revealed TCDD at 1.1 ppb. Laboratory analysts later revised the TCDD value following retesting; the retested value was 0.41 ppb. In this area, environmental contractors removed about 1 foot of gravel before reaching soil. A composite of all soil samples collected by the Nufarm contractors failed the Toxicity Characteristic Leaching Procedure with 4.6 ppm of Silvex.

On March 22, 2022, the Missouri Department of Natural Resources (Department) conducted a Fiscal Year 2022 annual site inspection, during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The Nufarm site is located on the alluvium of the Missouri River flood plain. The 60- to 100-foot-thick alluvium consists of low permeability, fine-grained clay and silt at the surface, grading with depth to coarser sand and gravel units with high permeability. Sand units typically are located within 20 feet below grade, and the gravel seams are present nearer the alluvium/bedrock contact. Depth to the water table is 10 to 20 feet. The alluvial aquifer, which is an important source of water for local industry, is in direct hydraulic communication with the Missouri River.

Under normal flow conditions, groundwater beneath the site flows west toward the Missouri River. The river occasionally floods the site, and high river stages could reverse the groundwater flow direction. High-yield wells near the site may also affect the groundwater flow's direction. Contaminant releases at the site would readily affect the alluvial aquifer through direct infiltration and dissolution.

The bedrock beneath the site is composed of Pennsylvanian-age limestones and shales. Since this type of bedrock exhibits low permeability, contaminant releases would have minimal effect on the bedrock aquifer. Due to heavy mineralization of water within the bedrock, local water suppliers do not use this aquifer as a water source.

Public Drinking Water Advisory:

Missouri American Water – St. Joseph draws water from the Missouri River alluvium, but its well field is upstream of this site, and no site-related impacts are expected. No other public water sources are located near the site.

Health Assessment:

TCDD and Silvex are the chemicals of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The site is located in an industrial area, but residential neighborhoods are less than 1 mile north and less than 0.5 mile southeast. The site is fenced and much of the TCDD contamination on the Nufarm site is subsurface and covered by clean soil and gravel.

Based on available information, the Missouri Department of Health and Senior Services has determined that this site does not appear to present a significant public health risk at this time. The site owners have placed an engineered cap over contaminated soils to prevent exposure. However, exposure to contaminated soil could occur if the site's use were to change or excavation or surface grading were to expose contaminated soil.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 573, Jefferson City, MO 65102, 573-751-6102.

Old Centralia Landfill

Site Name: Old Centralia Landfill

Classification: Class 3

Date of Registry Placement: August 20, 1990

Site Address: 0.6 miles west of Centralia, along north side of Highway 22, Boone County, Mo., SE 1/4, NW 1/4, Sec. 9, T51N, R11W, Centralia Quadrangle

Present Property Owner: City of Centralia

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Metals (primarily lead)

Quantity: Not determined

Site Description and Environmental Concern:

The Old Centralia Landfill site formerly operated as an open dump for the disposal of municipal and industrial solid waste. Because of past disposal practices, metals are present in soil.

The city of Centralia owns the property. The site has been inactive since 1961. Land use in the immediate vicinity is primarily agricultural row crops. Houses are scattered in all directions, except to the east, where the city of Centralia lies. The nearest residence is about 0.5 mile east. Goodwater Creek flows on the site's east side.

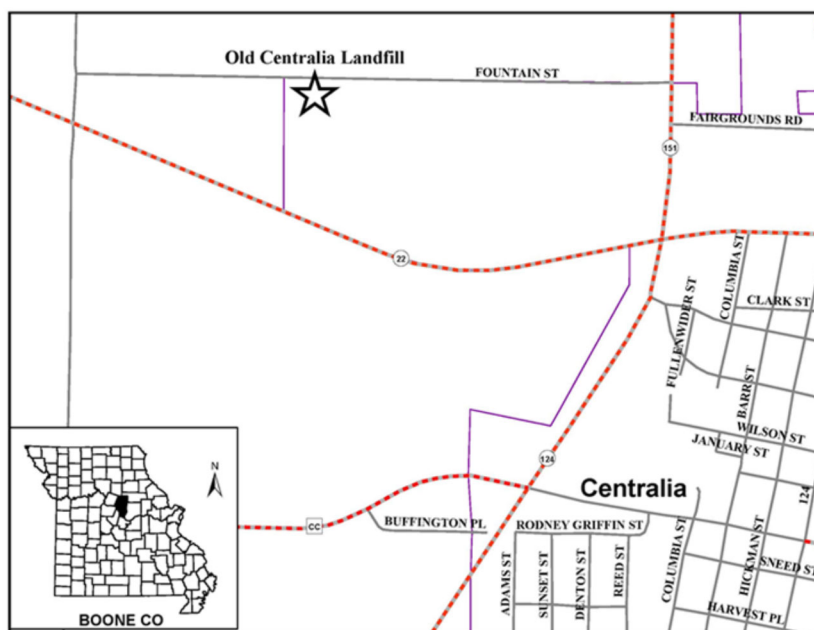
The city of Centralia operated the landfill from 1950-1961. Lead levels in soil are significantly above background and health-based screening levels in the landfill's northeast corner, thereby characterizing the contaminated soil as hazardous. The landfill's waste material (possibly industrial solvents, asphaltic paint, metal, and domestic refuse) was occasionally "open burned" and covered with soil. Missouri Department of Natural Resources (Department) reports state that unknown quantities of potentially hazardous materials, generated by the A. B. Chance Company, also were disposed periodically at the landfill and burned in the open. Neither the city nor A.B. Chance acknowledge having records of the amount and type of waste disposed in the landfill. A.B. Chance generated waste including industrial solvents, asphaltic paint, metals, and foundry waste during this time.

In 2002, sediment samples from nearby Goodwater Creek detected elevated metal concentrations (copper, lead, and nickel), indicating migration. The Department has documented leachate seeps at this site.

Remedial Actions:

In 1990, the Department completed a Site Inspection and requested that the U.S. Environmental Protection Agency (EPA) assess this site for a potential removal cleanup under Superfund. EPA recommended that the city of Centralia restrict access to the site.

During 1992, the city of Centralia fenced the site, posted "No Trespassing" signs, and installed a locked gate to eliminate access. However, during its annual Registry inspections since 1992, the Department repeatedly found the signs and gate damaged or inoperable. Debris found around and inside the fence indicates



trespassing. No further remedial actions have occurred. In 2002, the city re-graded the soil on the north end to control erosion. Elevated metals detected in subsequent sediment samples from nearby Goodwater Creek demonstrate that metals are migrating from the site, most likely attributable to past disposal activities.

On April 12, 2022, the Department conducted the Fiscal Year 2022 annual inspection. The Department documented that the landfill's cap is well vegetated, and no erosion or ponding were present on site.

General Geologic and Hydrologic Setting:

The site is located in an upland setting on a nearly flat, glaciated plain, and is characterized by 50 to 60 feet of glacial till, which is overlain by 3 to 5 feet of loess and topped with 2 to 3 feet of silty clay. Sand and gravel lenses may be present in the glacial till, but coarse-grained deposits are not continuous over a wide area. This profile represents undisturbed conditions; the depth of the landfill cut and the origin of the cover is unknown.

Geologic mapping indicates that underlying bedrock is composed of Pennsylvanian-age shales, limestones, clay, and coal beds. The glacial till and shaley bedrock have low permeability and thus form a confining layer that minimizes leachate migration into deeper groundwater supplies. Only shallow or poorly-constructed wells would be affected.

Public Drinking Water Advisory:

The city of Centralia operates two active public water wells located approximately 0.7 and 0.9 mile southwest of the site. Both wells are cased to over 400 feet deep; therefore, site-related impacts are not expected.

Health Assessment:

Lead is the major contaminant of concern found in soil, surface water, and sediment. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The highest potential routes of exposure are through direct contact with contaminated soil, sediment, and surface water. Soil samples from the northeast corner of the site show elevated levels of copper, lead, and nickel. Analysis of downgradient sediment and water samples indicated that contaminants have moved off site. Even though only one sample found phenanthrene, the presence of phenanthrene and other polycyclic aromatic hydrocarbons (PAHs) is possible because of past burning practices.

The potential for groundwater contamination may exist. Seepage from the buried wastes is occurring, and in time, contaminants could reach the groundwater. Two deep wells serve Centralia, but there are limited reports of other groundwater use in the immediate vicinity. Centralia and most rural homes in the site vicinity use public water. Missouri Department of Health and Senior Services (DHSS) found only one private well in the site vicinity. The well was sampled from 2003-2006 and tested for metals and volatile organic compounds (VOC). All analytes were below detection limits.

Based on available information, the contaminants at the site may present a health threat to the general public. The fact that contaminants have moved off site presents a potential risk because they are persistent in the environment and could eventually flow into Mark Twain Lake. Other considerations are: the contaminants could migrate into the groundwater; the public may disregard the access restrictions and become exposed when trespassing; and the maintenance of a utility transecting the site may expose workers to surface and subsurface soil contamination and landfill material. A Site Reassessment may better delineate concerns of off-site migration of remaining contamination.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Reichhold Chemical

Site Name: Reichhold Chemical

Classification: Class 3

Date of Registry Placement: March 15, 2001

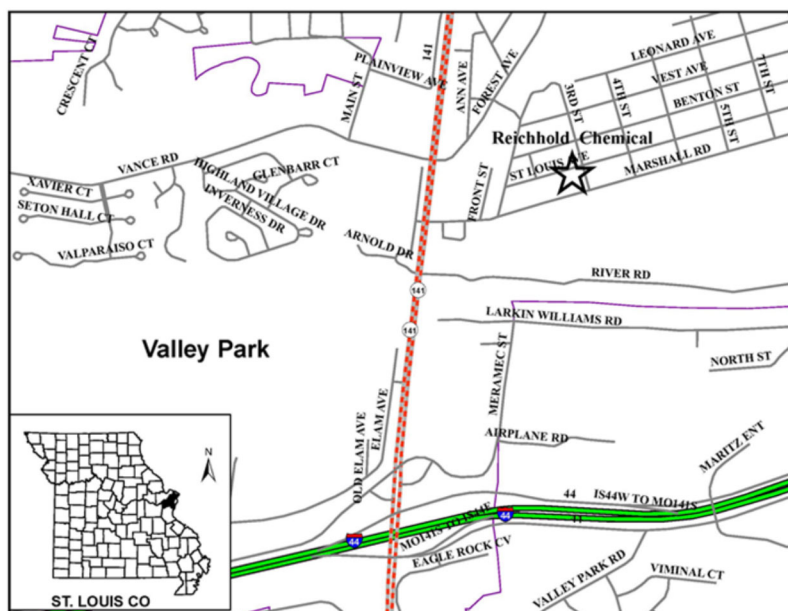
Site Address: 249 St. Louis Ave., Valley Park, St. Louis County, MO

Present Property Owner: Reichhold LLC 2

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Volatile organic compounds (VOCs), primarily xylene

Quantity: Not determined; an unknown volume of solvent was released, contaminating about 48,000 cubic feet of soil, which remains on site.



Site Description and Environmental Concern:

Reichhold Chemical (Reichhold) manufactures oil- and solvent-based resins. As part of the production process, the company used industrial-grade xylene to remove wastewater from the resin materials. In 1997, a release of an unknown volume of xylene-wastewater mixture occurred from the decanter tank containment drain. The solvents migrated along the conduit of a buried wastewater line and contaminated surrounding soils. As a result, xylene and ethylbenzene are present in the subsurface soil at concentrations above health-based screening levels.

The privately-owned site covers 2.5 acres surrounded by industrial, commercial, and residential property. Structures and a cement parking lot cover the fenced site. The cement parking lot acts as a cap that protects workers and other individuals from potential exposure to subsurface contamination.

The industrial grade xylene, a recovered chemical product, is U.S. Environmental Protection Agency (EPA) hazardous waste U239. Subsurface contaminants may pose human health risks if accidental uncovering, removal of the cement cap, or excavation occurs.

Remedial Action:

After a 1997 release of an unknown volume of solvent from the decanter tank containment drain, the owner repaired the faulty drain, sealed the decanter tank containment, and plugged the sewer lateral with cement to prevent further contamination of the sewer system. The owner installed a recovery sump in the sewer lateral to retrieve any free solvents that continued to infiltrate, but the owner recovered very little solvent.

In September 2000, the Missouri Department of Natural Resources (Department) completed an Integrated Preliminary Assessment/Site Inspection/Removal Site Evaluation. The Department concluded the parking lot effectively capped the soil contamination. Therefore, the Department did not recommend further action under the Comprehensive Environmental Response, Compensation, and Liability Act, provided institutional controls remain in place and the Department is ensured oversight of future activities.

In May 2003, the Department approved a change of use request for excavation and test borings for installation of a new product line. In December 2003, the Department approved a change of use request to

replace a leaky underground drain line in building 13. In 2015, the Department approved a change of use request to excavate (disturb) a small portion of the paved cap (cement cover). The excavation was required to relocate a portion of the wastewater subsurface drainpipe that is connected to an aboveground storage tank located inside a secondary concrete containment structure.

In March 2011, the Department and EPA conducted citywide groundwater sampling of the known monitoring well locations in Valley Park. The purpose of the groundwater sampling was to define the monitoring well locations and VOC plume boundaries in the off-site groundwater. During the monitoring, groundwater samples were collected near the Reichhold facility from: one intermediate well (MW-6B) screened at 45 feet deep; two monitoring wells (MW-6C and MW-10C) screened along the bedrock at approximately 60 feet deep; and, the industrial-production well located on the Reichhold site, which was screened at approximately 60 feet deep. All four of these wells had low-level concentrations of tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene. EPA and the Department did not detect benzene, toluene, ethyl benzene, or xylene (BTEX) compounds, or other identified compounds in the four wells associated with the release from the Reichhold aboveground decanter tank.

Based on these results, the contaminants associated with the release do not appear to be impacting the local aquifer at the intermediate and deep depths in these wells. Since the time of the release, either the Reichhold production well would intercept or detect any potential VOCs or natural processes would degrade them. Although the 2011 well data did not show VOCs associated with the release within the local aquifer at the depths indicated; however, a potential threat will exist as long as VOC contamination remains in the subsurface. The Department recommended follow-up groundwater sampling in the release area to determine if there was an impact to human health. In January 2015, EPA sampled two wells on the Reichhold property and detected concentrations of 57 parts per billion (ppb) acetone in both wells, 2.3 ppb cyclohexane in the intermediate well, and 1.3 ppb cyclohexane in the deeper well.

Between August 2012 and July 2016, EPA conducted a vapor intrusion (VI) assessment for the Valley Park TCE Superfund site at 34 properties (residences and businesses) adjacent to the two Superfund source properties, which was to include the Reichhold Chemical buildings. Reichhold refused access to EPA to conduct this VI sampling.

On May 3, 2022, the Department conducted the Fiscal Year 2022 annual inspection and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located nearly 0.3 mile north of the Meramec River on the 10-year flood plain. The surrounding terrain is flat with no levee between the property and the river. About 65 feet of moderately to highly permeable alluvium underlies the site. According to nearby monitoring wells, the alluvial sediments predominantly comprise silty sand with some clay and gravel in the upper 35 feet, overlying 30 feet of sand and gravel.

Depth to groundwater averages 30 feet and fluctuates with the river level and the Reichhold production well's pumping rates. Alluvial groundwater is recharged by surface infiltration and discharge from the bedrock hills located north and west of the site. Groundwater flows within the alluvium toward the Meramec River to the south-southeast. Locally, the alluvial aquifer is used for industrial wells and the city of Kirkwood's municipal wells. Bedrock consists of cherty, medium- to coarsely-crystalline 200-foot-thick Burlington-Keokuk Limestone. Voids have been found in the limestone bedrock; therefore, it is probably karstic. The bedrock aquifer is used as a drinking water source in the nearby upland areas, but not in the river valley.

Public Drinking Water Advisory:

No public water sources are located in the site's immediate vicinity. Missouri American Water – St. Louis Co. /St. Charles Co. draws water from the Meramec River more than 10 miles downstream of this site. No site-related impacts are expected.

Health Assessment:

The contaminants of concern at this site are VOCs, primarily xylene. Industrial-grade xylene typically

contains other solvents and may be as much as 30 percent ethylbenzene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with exposure to these contaminants.

The primary exposure route of concern is through groundwater. Although not currently active, Valley Park's public well field is downgradient and very near the site.

Although the 2011 well sample results at the Reichhold property did not show VOCs associated with the release, the 2015 sample results did show detections of VOC compounds. As long as VOC contamination remains in the subsurface, the Missouri Department of Health and Senior Services recommends that follow-up groundwater sampling continue to be conducted in the release area to determine if human health is being impacted.

Excavation of subsurface soil potentially could expose construction and/or site workers to VOCs in soil and shallow groundwater. In addition, vapor intrusion may be an exposure concern for VOCs associated with activities at the Reichhold facility released to the soil and groundwater.

Based on available information, a potential health risk exists at this site due to the possibility of vapor intrusion.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

R&O Processors/Lux Theater

Site Name: R&O Processors/Lux Theater

Classification: Class 3

Date of Registry Placement: October 9, 1996

Site Address: Church and Main, Granby,
Newton County, Mo.
SE 1/4, NE 1/4, NW 1/4, Sec. 6, T25N,
R30W, Granby Quadrangle

Present Property Owner: Ira and Betty
Hawkins

Lead Agency: Missouri Department of
Natural Resources (Department)

Waste Type: Metal plating wastes (lead,
cadmium, zinc, chromium, cyanide, nickel,
and copper)

Quantity: Not determined

Site Description and Environmental Concern:

The R&O Processors/Lux Theater site is a former electroplating facility located in downtown Granby. From 1973 to 1981, R&O Processors operated a metal-finishing plant at the site of the former Lux Theatre. Plating operations included zinc, chromium, nickel, black oxide, cadmium, and anodizing aluminum plating. Because of these operations, heavy metals and cyanide are present in surface soils.

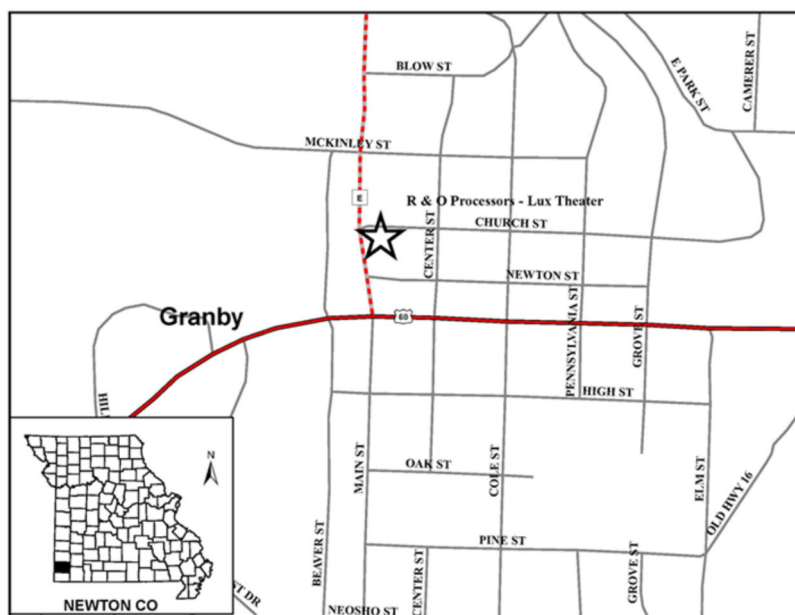
R&O Processors dumped an estimated 6 million gallons of metal-plating rinse water down an on-site 40-foot-deep mining shaft. The Department calculated this number based on records showing that 15,000 gallons of rinse water were disposed of on-site per week over an eight-year period. Robert Moffet, former facility operator, acknowledged that the rinse water contained cyanide and metals. The U.S. Environmental Protection Agency (EPA) documented this in a suit filed against Moffet in 1983. Cadmium has been detected in the groundwater at levels slightly above the Maximum Contaminant Level (MCL) of 5 parts per billion (ppb).

Clean concrete currently encases the former R&O Processors' building foundation. An alleyway separates the foundation from a residential property to the east. Main Street is the site's western border and Church Street is its northern border. The site is unsecured and readily accessible to the public.

Remedial Actions:

In 1985, part of the building collapsed, which required the entire building to be demolished. R&O processed hired Chemical Waste Management to clean up its building. Chemical Waste Management found 12 drums containing hazardous waste inside the collapsed building. Chemical Waste Management removed and moved them to the R&O Processors location on Highway 60 in Granby.

Department site investigations identified inorganic metals including cadmium, chromium, copper, cyanide, lead, nickel, and zinc in soil. The Department also found cadmium in groundwater. In 1998, the Missouri Department of Health and Senior Services (DHSS) completed a Streamlined Risk Assessment, which concluded that, although cadmium and copper were present in the soil above background levels, the metals



were not at levels that would cause health-related problems from worker exposure to the soil.

EPA's 1995 Expanded Site Inspection could not conclude definitively that the elevated metals in soil were attributable to the R&O site when compared to the background metal levels, which are high in Granby due to the area's mining history. EPA sampled the public wells as part of the Expanded Site Inspection, and none of the samples contained metals. EPA determined that no further federal action would be taken at this site.

In 2001, the owner donated the property to the Granby Economic Property Development Corporation (GEPDC). With Department approval, the GEPDC removed the former buildings, poured new foundations and concrete walls, and backfilled the site with gravel. Afterward, GEPDC used the property as a city parking lot. On Sept. 19, 2017, GEPDC sold the property to Ira and Betty Hawkins. The owner has plans to sell the property back to GEPDC in the near future.

On March 23, 2022, the Department completed the Fiscal Year 2022 Registry annual inspection and noted nothing of significance.

General Geologic and Hydrologic Setting:

In general, the uplands characterize the site's topography gently sloping to stream valleys. The site is located in an urbanized area where the topography has been altered by cut-and-fill excavation to provide a level surface for building construction. Natural surface soil is composed of cherty, red clay residuum that ranges from 10 to 40 feet in thickness. The soil is derived from weathering of the underlying bedrock. Generally, the fill is similar to natural soil, and both exhibit moderate to high permeability.

The upper aquifer is composed of Mississippian-age strata, which are primarily limestone units with a total thickness of 250 to 300 feet. The lower aquifer, encountered about 800 feet below grade, is composed of sandstone and dolomite units of Ordovician age. The upper and lower aquifers are separated by confining beds composed of shale. The limestone and dolomite units are highly permeable due to solution enlargement of bedding planes and joints. The local area is karst, characterized by sinkholes, losing streams, springs, and caves.

Most private residences obtain water from low-yield wells that penetrate the upper bedrock aquifer and, in some cases, the overlying residuum. Water supply wells that require high yields, such as municipal wells, penetrate the lower aquifer. Poorly constructed wells may facilitate migration of contaminants from the ground surface to the deeper, potable aquifers.

Public Drinking Water Advisory:

The city of Granby uses two public water wells that are located approximately 0.5 mile to the west and 0.8 mile southwest of the site. Both wells draw from the Ozark aquifer and are cased at least 450 feet deep. Contamination from the site is not likely to impact these wells, but questions regarding the extent of groundwater contamination in the upper Springfield Plateau aquifer (characterized by karst features, rapid groundwater movement, and surface water infiltration) are still a concern. Existing wells that are poorly constructed or abandoned, or fractures in bedrock may allow localized mixing between the upper and lower aquifers.

Health Assessment:

The contaminants of concern at this site are heavy metals and cyanide. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Gravel and concrete, added to the site in 2001, reduced the potential for exposure through contaminated soil. The primary health concern is potentially contaminated groundwater. Groundwater apparently flows northward toward a losing stream. The site's proximity to the municipal well and the area's karst geology contribute to health concerns.

In 2002, DHSS sampled a subdivision well located east of the site, and samples contained lead below the action limit of 15ppb. In 2002, DHSS also sampled a private well near the site and found that it contained

lead above the action level of 15 ppb, and cadmium above EPA's MCL of 5ppb. In 2003, and again in 2005, this private well contained a cadmium concentration of 6 ppb, which is slightly higher than the MCL. In 2007, this residence had a new well drilled. Later that same year, DHSS analyzed a water sample from this new well. The sample did not detect any metals above the EPA's MCL.

In 2009, a tornado caused power outages in the area for several weeks. None of the private well owners wanted their wells tested after the power was finally restored. No one has sampled the wells around the site since 2007, because many of the homes were demolished after the tornado. The nearest remaining home appears abandoned. Remaining well owners on the original sampling plan denied access for well sampling, and the status of their wells remains unknown.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, (573) 751-6102.

Sentinel Wood Treating

Site Name: Sentinel Wood Treating

Classification: Class 3

Date of Registry Placement: September 11, 1998

Site Address: 412 NW 12th St., Ava, Douglas County, MO

Present Property Owners: Sentinel Industries, Inc.

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Pentachlorophenol (PCP), arsenic, and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description:

The Sentinel Wood Treating site is a former wood-treating facility located in Ava, Missouri, that used pentachlorophenol (PCP) and diesel fuel in its pressure-treatment process. Because of past manufacturing practices, PCP is present in soil and groundwater.

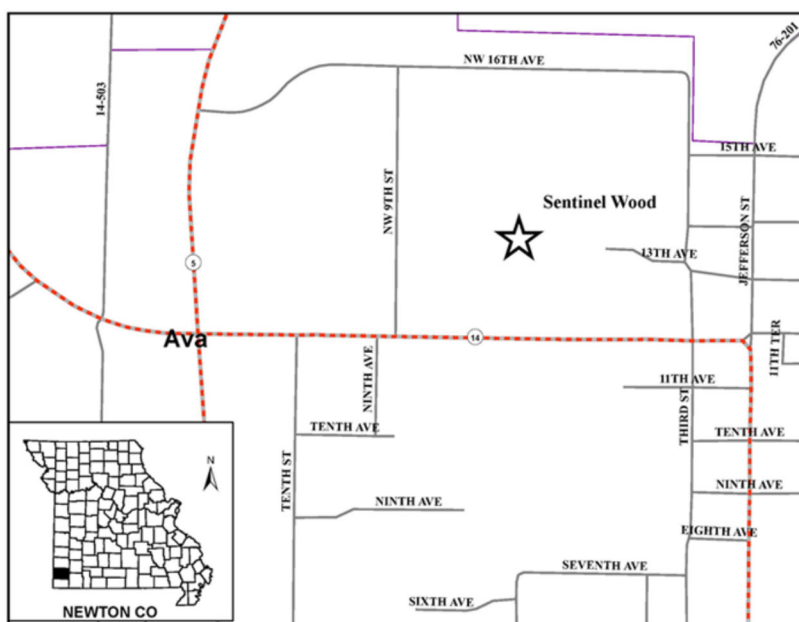
The privately owned site is approximately 14 acres in size and is located in a mixed commercial/manufacturing/agricultural setting, with private residences located to the south. The site's former wood-treating (southern) portion currently has several retail shops, multiple outbuildings from the wood-treating operations, and a parking lot.

Sentinel Industries, Inc. (Sentinel) treated wood with PCP from 1959 to approximately 1978. The pressure-treatment process created a thick sludge of waste material, some of which Sentinel burned in an on-site boiler and disposed of the remainder in three on-site lagoons. Sentinel eventually closed the lagoons in place between 1978 and 1979, after it ceased on-site pressure-treating operations.

In July 2000, the U.S. Environmental Protection Agency (EPA) detected PCP at levels above those considered safe for unrestricted use of the property in the downgradient groundwater. PCP levels have decreased in the surface water downstream of the site due to removal actions conducted between 2004 and 2007.

Remedial Actions:

A number of site investigations found elevated PCP levels and other wood-treating contaminants in lagoon samples, in shallow groundwater near the lagoons, and in soil at other areas of the property. In 2002, the Missouri Department of Natural Resources (Department) completed an Expanded Site Inspection to define the nature and extent of on-site and off-site contamination. During the inspection, the Department also documented PCP and solvents, which were not attributable to the site, in downstream surface water. The Department found the VOCs attributable to the 12th Avenue Solvents and Community Laundromat sites. The Department sampled the city of Ava's municipal wells, certain private wells, and a spring. Sampling results showed PCP in three private wells at concentrations below EPA's maximum contaminant levels, and no PCP



in Ava's municipal wells. In 2002, the Missouri Department of Health and Senior Services tested six private wells and found no detections of either PCP or 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin).

In July 2000, EPA initiated another site investigation, which confirmed the presence of elevated levels of TCDD, PCP, and polycyclic aromatic hydrocarbons in the soil and sludge from the lagoon area. The investigation also found arsenic contamination in the site's northeastern portion, and low levels of TCDD and PCP in perched groundwater, creek water, and sediments.

In 2004, Sentinel committed to conducting removal actions to prevent further release of PCP to downstream surface water and groundwater. The removal actions included relocating previous land-farming areas, then excavating and biologically treating contaminated soils from the former treatment plant area in dedicated bioremediation cells. By December 2007, PCP levels had decreased significantly in surface water downstream of the site. Surface water PCP concentrations continue to remain at low levels downstream of the site, except for slightly elevated levels at two locations near the property line.

Sentinel oversees the monitoring of surface water, groundwater, and biological treatment, and reports to EPA on a semi-annual basis. Planned remediation will consist of continued PCP treatment in biocells, with continued monitoring of groundwater and surface water.

In February 2019, Sentinel's environmental consultant treated 2,000 gallons of contaminated groundwater on the site's southern portion with activated carbon. After Sentinel attained PCP results below action levels through treatment, the operation released the treated groundwater to the creek. Concentrations in groundwater have gone down. However, the potentially responsible party (PRP) needs to excavate and treat soil hot-spot areas. In addition, the PRP has not excavated the lagoon area. The PRP continues to excavate and treat the contaminated soils, and monitor the groundwater. The PRP will continue this for several more years.

On May 25, 2022, EPA filed and recorded a Notice of Contamination on approximately 1.15 acres in the southeast area of the Sentinel property. This is due to xylenes, one of the 12th Avenue Solvent site's contaminants, present in the groundwater on the Sentinel's property above 400 micrograms per liter (ug/l). The concentration of 400 ug/l for total xylenes was determined to be the acceptable groundwater concentration for a utility/construction worker. The notice will be protective for utility and construction workers who may perform work in that area. EPA filed the notice in the property chain-of-title because the owner refused to have an Environmental Covenant filed on the property.

On April 5, 2022, the Department conducted the Fiscal Year 2022 annual inspection and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located on an upland setting in the hilly Ozark Plateau physiographic province. Soils are composed of cherty, silty clay residuum developed from the underlying bedrock, the Ordovician-age Jefferson City Dolomite. Soil thickness is about 20 feet.

Wells in this area produce water from the Ozark Aquifer, which is composed of carbonates and sandstones. The city of Ava has drilled five municipal wells within Section 11. These wells are more than 800 feet deep, extending into the Gunter Sandstone. Domestic wells in the area extend to depths ranging from 150 to 315 feet. Casing lengths extend from 4 to 294 feet. The Jefferson City Dolomite acts as a leaky confining unit. Contaminants migrating into the subsurface via vertical bedrock fractures or poorly constructed wells could move into domestic water sources, depending on groundwater flow direction and the nature of contaminants.

Surface water flows off site to the south where it enters Prairie Creek. Prairie Creek is a losing stream that flows westward. Contaminants that enter Prairie Creek in run-off may flow several miles to the west, reaching the water table along losing segments of Prairie Creek.

Public Drinking Water Advisory:

The city of Ava uses three deep wells that draw from the Ozark aquifer. One well is located just over 650 feet from this site; one is located approximately 0.5 mile east of the site; and one is approximately 1 mile

southeast of the site. The well closest to the site is cased to 390 feet deep, while the others have more than 400 feet of casing. Quarterly monitoring of the city's wells did not detect site-related contamination, and system wells returned to standard annual monitoring for PCP (and other synthetic organic chemicals) in May 2009. With continued management of the site, no impacts are expected.

Health Assessment:

Chemicals of concern at this site include PCP, arsenic, and TCDD. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with exposure to these contaminants.

EPA continues to oversee the site and actions to treat on-site groundwater and soil. Removal actions are ongoing. Based on available information, the site poses a minimal public health risk, as long as contamination does not travel off site.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

St. Charles FMGP

Site Name: St. Charles FMGP

Classification: Class 3

Date of Registry Placement: December 12, 2000

Site Address: Southwest corner of the intersection of North Riverside Drive and Monroe St., St. Charles, St. Charles County, Mo.

Present Property Owner: city of St. Charles

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Coal tar, which contains volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs)

Quantity: Not determined

Site Description and Environmental Concern:

The St. Charles FMGP site is the location of a former manufactured gas plant (FMGP) that operated from approximately 1886 through 1929. An asphalt parking lot covers the site, located in St. Charles' downtown historic district. Former structures included a 35,000-cubic-foot capacity gasholder, a 50,000-cubic-foot capacity gasholder, a purifying room, raiser, retorts, and various tar storage tanks. While no longer visible at the surface, partially-intact FMGP structures may be present beneath the site.

Subsurface soil samples collected from the approximate location of the FMGP contained volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs) at concentrations exceeding health-based screening levels. The coal tar remaining in the subsurface may pose human health risks if any type of excavation or accidental uncovering occurs.

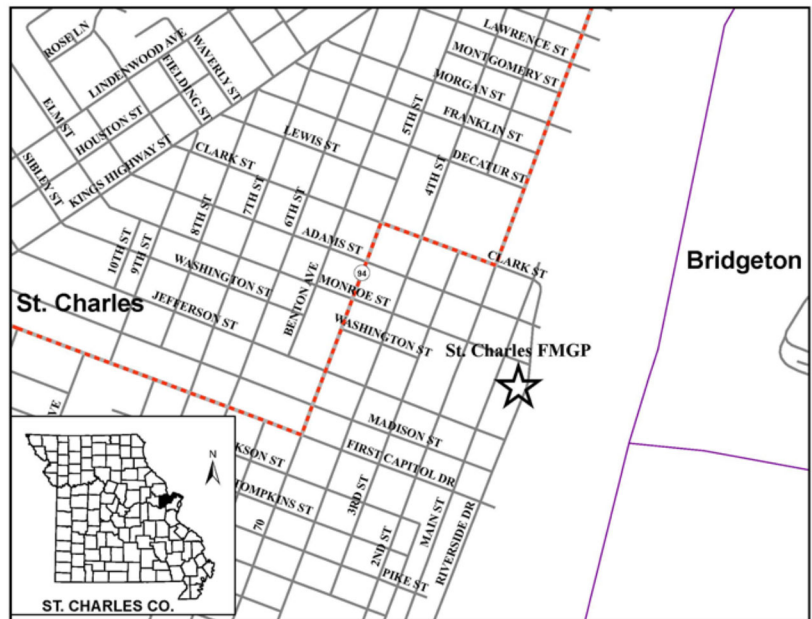
Remedial Action:

The Site Screening investigation report concluded that the asphalt parking lot acts as a cap, protecting workers and other individuals from potential exposure to subsurface contamination. Further assessment, including the use of equipment to penetrate on-site concrete, would compromise the integrity of an apparently effective cap. Such action was not recommended at the time of the Site Screening investigation report, provided that institutional controls are in place and state oversight of future activities is ensured. If the parking lot's asphalt is ever removed, further sampling is recommended. The owner is also responsible for maintaining the cap and any repairs it may need.

On May 3, 2022, the Missouri Department of Natural Resources (Department) conducted the Fiscal Year 2022 annual inspection, during which the inspector noted that the site was well maintained. City officials notified the Department that the asphalt parking lot would be resurfaced in the fall of 2023.

General Geologic and Hydrologic Setting:

The site lies on a west slope along the Missouri River at the edge of the 100-year flood plain. Approximately



10 feet of silty, sandy loam with moderate permeability lie beneath the site, where it has not been excavated or covered with fill.

Groundwater within the surficial materials recharges the Missouri River to the east. Precipitation has little chance of infiltrating the unconsolidated materials, due to pavement and structures that cover the ground surface. Therefore, most water within the residuum originates from the Mississippian-age limestone hills to the west.

The Mississippian-age, finely-crystalline, 85-foot-thick St. Louis Limestone bedrock lies less than 10 feet deep. This limestone formation exhibits secondary dissolution features that add to its permeability. Deeper strata include the 115-foot-thick, coarsely-crystalline Salem Limestone and the 115-foot-thick, fossiliferous limestone of the Warsaw Formation.

While the deep bedrock aquifer is used in the local hills as a water source, the alluvial aquifer is hydraulically down-gradient (a discharge area) of the bedrock aquifer. Therefore, contamination originating from a source area in the flood plain is highly unlikely to impact the bedrock aquifer.

Public Drinking Water Advisory:

The nearest public water well is located more than 3 miles north of the site. Missouri American Water – St. Louis County/St. Charles County draws water from the Missouri River more than 7 river-miles downstream from this site; therefore, no site-related impacts are expected.

Health Assessment:

The chemicals of concern at this site include coal tar, which contains VOCs and semi-volatile organic compounds, including PAHs. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Little opportunity for human exposure exists, because an asphalt parking lot covers the site. However, if the site is disturbed, site workers and nearby residents may be exposed to harmful levels of contaminants within subsurface soil through ingestion, dermal absorption, or inhalation of dust and vapors. It is not known whether groundwater is impacted; however, no private wells or other groundwater use have been identified.

Currently, no health risk is expected, because exposure is not occurring. If site conditions change, such that exposure to contaminated soils occurs, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, or by phone at (573)-751-6102.

Stratman Lumber

Site Name: Stratman Lumber

Classification: Class 3

Date of Registry Placement: November 22, 2000

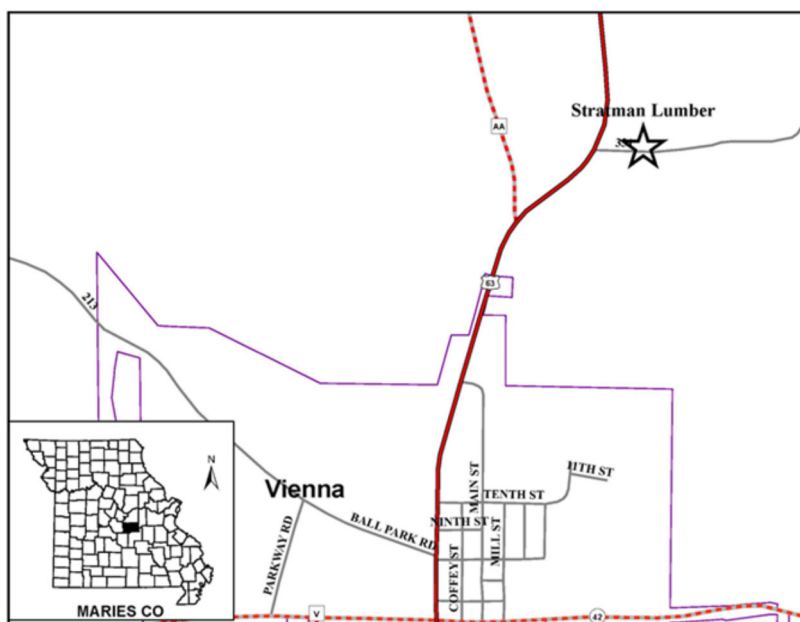
Site Address: 0.1 miles east of the intersection of U.S. Highway 63 and County Road 331, north of Vienna, Maries County, Mo.

Present Property Owner: Mickey Jones

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Pentachlorophenol (PCP)

Quantity: Not determined



Site Description and Environmental Concern:

The Stratman Lumber site is a former wood-treating facility located in a rural setting just north of Vienna. Mid-Mo Post and Lumber, Inc., known locally as Stratman Lumber, operated at the site from 1967 until 1979. Past releases of the wood preservative pentachlorophenol (PCP) caused on-site soil contamination.

The site was a privately owned wood-treating facility on 8 acres of land; however, the wood-treatment area, and a majority of the contamination, was located on 3.4 acres. The nearest residence is directly west of the site. The only remaining on-site structure is an empty pole barn. The site is heavily vegetated, with household trash and mulch piles along the site's western border.

Stratman Lumber purchased, treated, and sold wood posts and lumber of hardwood and softwood species. The wood-treating operation included a vacuum system consisting of three tanks connected by piping: a treatment tank for the wood, a storage tank for the PCP, and an oil/water/impurity separator. Sometime in the 1960s, vandals reportedly trespassed onto the site and loosened bolts on the wood-treating cylinder, allowing PCP to spill onto the ground. In 1994, a subsequent owner dismantled and moved the wood-treating tanks, established a sawmill operation, and fenced off the property. The sawmill operated for approximately one year with about five employees, but closed in 1995 due to the potential health risk to workers from exposure to on-site contamination.

In 1994, the Missouri Department of Natural Resources (Department) documented PCP at concentrations above health-based screening levels in on-site subsurface soil. In 1999, the U.S. Environmental Protection Agency (EPA) conducted a removal action that included removing 527 tons of contaminated soil. However, PCP-contaminated soil, with concentrations exceeding residential health-based screening levels, remain on site.

Remedial Action:

In 1997, the Department conducted a Removal Site Evaluation to determine the extent of PCP soil contamination. Analytical soil sample results documented PCP contamination within a 4,440-square-foot area to a depth of 3 feet. The contaminated area consists of a 10,000-gallon PCP storage tank near the eastern edge of the PCP-contaminated area. The tank contained approximately 1,532 gallons of an oily liquid as of the Aug. 5, 1997, Removal Site Evaluation sampling event.

On July 16, 1999, Ecology & Environment, Inc. (E&E), an EPA contractor, delineated 110 cells, each measuring 14 feet by 14 feet, around the contaminated area. Results from the July 1999 sampling events and previous Department sampling identified 19 of those cells that exceeded the site's removal action level of 220 parts per million (ppm) PCP, with concentrations up to 5,920 ppm.

Starting in November 1999, E&E excavated the 19 cells to depths of contamination determined from previous sampling. After the initial excavations, follow-up sampling analysis identified PCP contamination above the site action level remained in 11 of the 19 cells. E&E conducted additional excavation within these 11 cells until sampling confirmed that PCP contamination levels were below the site action level. Following the excavation of all 19 soil cells, E&E backfilled the excavated cells with clean soil and began tank-cleaning activities. E&E drummed and shipped the remaining 360 gallons of liquid and 5,197 pounds of sludge from the tank for disposal, and the interior was steam cleaned with a power washer and degreasing solutions. E&E screened a wipe sample of the interior with results indicating PCP levels below 10 ppm.

On Dec. 6, 1999, E&E completed the removal action, which addressed all known areas of PCP soil contamination exceeding the site action level of 220 ppm. However, soils containing PCP with concentrations exceeding residential health-based screening levels remain on site; therefore, the site will remain on the registry.

On June 14, 2022, the Department conducted a physical site inspection and reported no significant changes at the site. Inspectors did note that the owner has not mowed the site and it is heavily vegetated, with various piles of wood mulch, household trash, old vehicles, and deteriorated sheds located on the property.

General Geologic and Hydrologic Setting:

The site is located within the Salem Plateau, part of the Ozark Plateau of the Interior Highlands Physiographic Province. It is located on a ridge near the divide between the Maries and Gasconade rivers, and encompasses the divide between two small tributaries to the Gasconade river. The site's southern part is within the Indian Creek drainage and the northern part drains toward Crumb Creek. The site is located about 1.9 miles west of and 285 feet higher in elevation than the Gasconade River.

Jefferson City Dolomite, a medium- to finely-crystalline dolomite, underlies the site. The lithology is variable and includes thin beds of clayey dolomite, brecciated chert, shale, and occasional sandstone. Less than 10 feet of surficial materials cover the Jefferson City Dolomite, consisting of very little soil over the thin cherty residuum. The bedrock below the site is not karst.

The Ordovician-age Jefferson City Dolomite is part of the Ozark Aquifer, which is the principal aquifer of the Salem Plateau region. In addition to the Jefferson City Dolomite, the Ozark Aquifer is composed of the Ordovician-age Roubidoux Formation, Gasconade Dolomite, the Cambrian-age Eminence Dolomite, and Potosi Dolomite. Geologists estimate the total Ozark Aquifer's thickness at this site is 1,000 feet.

Residential wells obtain water from the Ordovician-age formations, and the city of Vienna public drinking water well extends into the Potosi Dolomite. Geologists estimate the depth to the regional water table to be 100 to 150 feet below the ground surface. The groundwater flow's direction is unknown. Because of the Jefferson City Dolomite's low vertical permeability, perched water may be located at the top of unweathered bedrock. The Ozark Aquifer is probably not at significant risk of site-related contamination.

Public Drinking Water Advisory:

The city of Vienna draws water from the Ozark Aquifer from two deep-rock wells located between 0.7 and 1 mile south of this site. In response to detection of PCP in one of the city's wells, the system began quarterly monitoring, but documented no additional detections. The city returned to annual well monitoring in 2013. Due to groundwater contamination in the area (unrelated to this site) and to potential PCP migration from this site, monitoring data from the city of Vienna's well should be closely scrutinized to identify any potential increases in contaminant concentrations that may affect its wells.

Health Assessment:

PCP is the major contaminant of concern at this site. The PCP used to treat lumber at the site may have

been technical-grade PCP, which routinely contained a variety of contaminants, including tri- and tetrachlorophenol, hexachlorobenzene, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans. Due to the presence of contaminants, PCP's precise toxicity is difficult to assess. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with PCP.

Site-related public health concerns involve exposure to contaminated soil, surface water, and groundwater. PCP remains in soil at concentrations up to 220 ppm. While this value is protective of the casual trespasser, it is not considered protective enough to allow residential development, and is marginal for industrial use. Leaching of PCP to groundwater may also occur.

In 1994, both the Department and the Missouri Department of Health and Senior Services (DHSS) sampled private wells in the vicinity for metals and organic compounds. While no PCP was found in any of the samples, both copper and zinc were detected. The Department and DHSS attributed the presence of copper to background sources, while zinc was site-related. The detected levels of metals were below unsafe levels for drinking water.

In 2008, the DHSS sampled two private water supplies adjacent to the site for PCP, which were both non-detect. One private water supply remains on site, but DHSS did not sample it during the event. A non-community public water supply, which serves the shooting range on County Road 331, also was not sampled. According to one landowner, a spring is located within 1 mile northeast of the site.

There is a potential for exposure to residual contamination through direct contact with surface soils and dust. Exposure pathways, such as volatilization of PCP to indoor air and ambient air, are not expected to be significant, because of site remediation, the potential for breakdown of PCP in surface soils, and PCP's limited volatility. Unless deeper soils are excavated, visitors and workers are not expected to be exposed to subsurface soil contamination.

Based on available information, the contaminants at the Stratman Lumber site present a potential public health threat. The PCP remaining in on-site soil presents a potential on-site risk from direct exposure to soils, and an off-site risk from contaminant migration in groundwater. DHSS therefore recommends that all contact with the contaminated soil be kept infrequent and restricted only to non-invasive activities. Prior to further site development, additional soil testing should be performed. Follow-up sampling of the on-site well, a non-community public water supply serving a shooting range on County Road 331, and a spring that might be located within 1 mile northeast of the site, is recommended to reassess possible off-site migration and exposure to contaminants.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Syntex Springfield

Site Name: Syntex - Springfield

Classification: Class 3

Date of Registry Placement: January 1, 1984

Site Address: 2460 W. Bennett St.,
Springfield, Greene County, MO

Present Property Owner: Euticals/AMRI
(Euticals, Inc., a subsidiary of Albany
Molecular Research, Inc.)

Lead Agency: Missouri Department of
Natural Resources (Department)

Waste Type: Volatile organic compounds
(VOCs), semi-volatile organic compounds
(SVOCs), and 2,3,7,8-Tetrachlorodibenzo-p-
dioxin (TCDD)

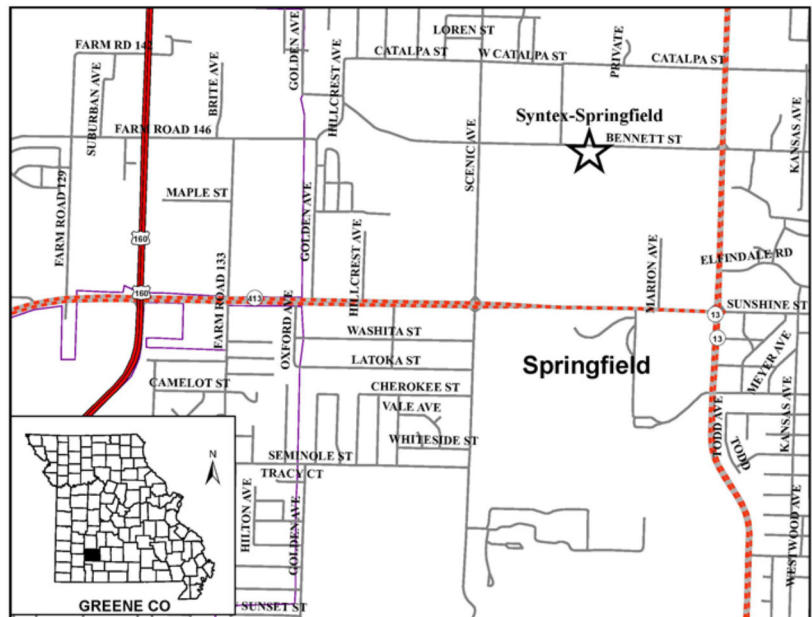
Quantity: Not determined

Site Description and Environmental Concern:

This site is an active chemical manufacturing facility. The facility has produced a variety of compounds over the years. Some products include food additives, alcohol denaturants, disinfectants, herbicides, and pharmaceutical products. Volatile organic compounds often were used as raw materials at the facility, including methylene chloride, toluene, xylene, 1,2-dichloroethane, methanol, benzene, and chloroform. A byproduct of some of the production lines was 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

The privately owned Curia Missouri, Inc. (Curia) () plant is approximately 72 acres in size. The active portion of the facility occupies about 7 acres and contains a number of buildings that house manufacturing, product, and raw-material storage facilities, quality control and process-development laboratories, maintenance, and administration. The remaining acreage is undeveloped. The Union Pacific Railroad and the associated easement form the western boundary for the property's northern half. Curia also leases two small portions of the Union Pacific property, which contain Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) monitoring wells.

Syntex managed hazardous wastes generated by past plant processes in a surface impoundment at the facility. The impoundment operated as a settling pond in conjunction with on-site wastewater treatment. The impoundment operated from the late 1950s until early 1970s. Prior to 1960, the facility discharged waste through separate underground sewer lines that began at production buildings and emptied into a ditch along the property's western side ("West Ditch"). From approximately 1960 through 1965, the underground sewer lines expanded to connect all buildings, laboratories, and the Pilot Plant. The underground sewer lines led to two common north-south underground vitrified clay pipes. One of the pipes emptied directly into a surface impoundment (now former surface impoundment, or FSI) built in the old stream channel of Jordan Creek, and the other pipe emptied into a brick-lined settling pit prior to discharging into the FSI. The FSI then discharged directly into Jordan Creek. After 1965, Syntex built an aeration basin and pumped wastes to the aeration basin prior to discharging to the Springfield Publicly-Owned Treatment Works (POTW). Syntex used the impoundment for managing hazardous wastes from the early 1970s until 1982, when it was decommissioned. In 1975, the facility partially closed the impoundment's southern portion by filling it with soil, rock, and concrete. The facility then capped the closed portion with an interim hazardous waste concrete



storage pad. The remainder of the impoundment physically closed in 1985 pursuant to a Missouri Department of Natural Resources (Department)-approved closure plan.

Past operations and waste management practices have impacted soil and groundwater quality at the facility. Hazardous wastes and constituents released from the former surface impoundment are the primary environmental problems. Residual dense non-aqueous phase liquid is present in soil and bedrock, and contaminated aqueous phase liquid is present in the alluvial and upper bedrock zones. The vertical and horizontal extent of dense non-aqueous phase liquid and aqueous phase liquid contamination has been determined.

The site is located in the flood plain at the confluence of Fassnight, Jordan, and Wilson creeks, which gives it high priority because of the extent of contamination and possible threat to public health and the environment from potentially contaminated surface water and groundwater. The Department sampled water from Wilson Creek and area drinking water wells. Results of these analyses showed no contamination attributable to releases at the facility. In addition, Curia sampled Wilson, Jordan, and Fassnight creeks and found no contamination attributable to releases at the facility.

Remedial Actions:

In September 1983, Syntex alerted the Department and the U.S. Environmental Protection Agency (EPA) that various site investigation and groundwater monitoring activities confirmed the release of hazardous wastes to soil and groundwater from the surface impoundment. On Sept. 14, 1983, the Department issued an emergency directive to Syntex. This directive required the company to: (1) immediately install a portable water treatment system; (2) immediately eliminate all discharges of wastewater into the impoundment; (3) immediately install aboveground, lined containment tanks; (4) pump water from the impoundment through the portable water treatment system; and, (5) sample the treated water and report the results to the Department.

Syntex implemented the emergency directive. Treatment included removing water from the impoundment. After analysis showed the treatment was effective, Syntex discharged the treated water into the Springfield sewer system. A concentrated sludge remained on the bottom of the lagoon.

On Sept. 20, 1983, the Department issued an order to Syntex requiring the company to submit to the Department and EPA a closure plan for the surface impoundment and a remedial action plan for cleanup of contamination in the alluvium and groundwater. The order also required installation of new monitoring wells at the facility to determine the extent of contamination. On July 6, 1984, the Department approved the closure and remedial action plans.

Syntex initiated steps to close the surface impoundment by treating contaminated water, stabilizing and excavating contaminated sludge, and placing the contaminated solids in a large reinforced concrete storage area permitted under RCRA. In 1988, Syntex removed the stored solids from the storage tank and incinerated the solids at the Denney Farm site. Following the initial stabilization and removal of contaminated soil and sludge, verification sampling was performed to ensure adequate solids removal. Syntex installed a French drain in the impoundment's floor area, and the remainder of the impoundment was filled with clean, compacted clay and capped with gravel. An engineered concrete cap covered the impoundment.

Syntex operated under a Department-approved post-closure plan, due to the hazardous waste constituents left in place. The plan required continued groundwater monitoring for previous releases from the former impoundment. In addition, Syntex addressed further investigation, monitoring, and remediation of groundwater and soil contamination at the facility under the terms of a RCRA Corrective Action Order on Consent negotiated between Syntex and EPA. EPA and the Department approved Syntex's RFI work plan. The RFI's scope included the following: (1) characterize the potential pathways of contaminant migration; (2) characterize the source(s) of contamination; (3) define the degree and extent of contamination; (4) identify actual or potential receptors; and (5) support and develop or refine the corrective measures.

Syntex's 1996 RFI demonstrated that pumping wells capture contaminated groundwater, and the confined contamination is within the facility's property boundary. Curia sampled Wilson, Jordan, and Fassnight creeks in 2005, 2006, 2008, 2011, and 2012, and found no contamination attributable to releases at the facility. As part of the final remedy, Curia is required to continue sampling the nearby creeks.

In January 2002, the facility submitted a final Corrective Measures Study Report to the Department and EPA, identifying and evaluating potential remedial alternatives. In March 2005, the Department and EPA approved the final report. On Sept. 30, 2010, the Department and EPA issued a final remedy decision and issued final hazardous waste permits to Curia. The Department issued the final Missouri Hazardous Waste Management Facility Part I Permit. EPA issued the draft Hazardous and Solid Waste Amendments Part II Permit. On Oct. 1, 2020, the Department renewed the Missouri Hazardous Waste Management Facility Part I Permit. The hazardous waste permit requires Curia to conduct corrective-action activities to ensure that the contaminant plume does not pose a threat to human health or the environment.

The hazardous waste permit outlines the final remedy, which includes enhanced institutional controls, dense non-aqueous phase liquid recovery, surface water monitoring of creeks, groundwater containment and monitoring, and continued monitoring and maintenance of the closed, capped former surface impoundment.

Monitoring of surface water is completed at three chemical monitoring locations: Jordan Creek Upstream, Fassnight Creek Upstream, and Wilson Creek Downstream. There are 64 groundwater monitoring wells at Curia. Curia samples 30 of the 64 wells for groundwater contaminants. In August 2012, Curia installed three dense non-aqueous phase liquid recovery wells as part of the final remedy implementation. Contaminated groundwater is recovered via six extraction wells and the French drain. Curia's groundwater treatment plant includes phase separators, a holding tank, a cartridge filter, and an air stripper. The treated water is stored in holding tanks, tested, and released to Springfield's sewers.

The Missouri Hazardous Waste Management Facility Part 1 Permit regulates the final remedy's continued operation and maintenance. The Department is reviewing a draft Environmental Covenant and an Operation, Maintenance, and Monitoring Plan. If the contaminated groundwater poses a threat from significant off-site or vertical movement, the final permit also outlines the options that the Department will pursue. The Department is the lead agency for corrective actions through a corrective-action transition plan with EPA.

On June 28, 2022, the Department conducted the Fiscal Year 2022 annual inspection. The inspector reported that no significant change in site conditions have occurred since the 2021 inspection.

General Geologic and Hydrologic Setting:

The site is located on the flood plain of Jordan Creek near its junction with Fassnight Creek. The unconsolidated surficial materials at the site consist of 5 to 16 feet of fill material composed of silty, gravelly clay with minor amounts of sand. The fill is underlain by 0.5 to 20 feet of silty clay alluvium containing interspersed sand and gravel zones. Permeability of the alluvium varies based upon composition, with highest permeability in the sand and gravel zones.

Groundwater generally occurs at 8 to 15 feet below ground surface within the fill and alluvium. The direction of groundwater flow within the alluvium is generally toward Jordan Creek. Fassnight and Jordan creeks, which merge to become Wilson Creek, appear to be gaining streams near the site.

Bedrock immediately underlying the alluvium is the Mississippian-age Burlington-Keokuk Limestone. The cherty limestone extends to a depth of approximately 280 feet to the top of the Northview Formation. Regionally, the Northview Formation is a confining layer that separates the shallow Mississippian-age limestones from the deeper Ordovician-age dolomites and sandstones.

The facility installed monitoring wells in several different horizons within the alluvium and limestone bedrock. Water level information from these wells indicates a good hydraulic connection between the alluvial sediments and the upper shallow bedrock. Water levels in wells installed in deeper horizons of the shallow bedrock aquifer indicate a poor or very poor connection. These wells have significantly lower water levels and very low yields. These facts, together with the pumping test data, suggest that low-permeability zones exist in the lower part of the shallow bedrock.

Contamination affects both the alluvium and the shallow bedrock aquifer. Contaminants observed in several of the deeper monitoring wells indicate that downward contaminant migration has taken place.

Public Drinking Water Advisory:

The city of Springfield uses groundwater and surface water as a primary source of drinking water. Site-related contamination is unlikely to influence the surface water sources, and the groundwater sources are deep wells that draw from the lower Ozark Aquifer. A low-permeability layer of shale lies between the shallow Springfield Plateau Aquifer and the deeper Ozark Aquifer in this region. Although there are areas where mixing between the shallow and deep aquifers occurs, the city of Springfield's wells are not expected to be impacted by site-related contamination. The closest public water well to this site belongs to a motor lodge located approximately 1.5 miles west of the site. This system uses an old well that predates modern well construction standards and has a very shallow casing that likely allows the well to draw water from both the shallow and deep aquifers. Given the karstic nature of the shallow aquifer, this well may be particularly vulnerable to shallow subsurface or surface contamination from this or other sites in the area.

Health Assessment:

The following are the major contaminants of concern found at the site: acetone, benzene, bromochloromethane, chloroform, chloromethane (methyl chloride), 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,2-dichloroethane, 1,2-dichloropropane, ethylbenzene, methylene chloride, 2-Methylnaphthalene, phenol, TCDD, toluene, trichloroethene, vinyl chloride, xylenes, arsenic, barium, and nickel. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Ingestion and inhalation are the primary routes of exposure since chemicals have leached into groundwater. If chemical fumes are inhaled or if a chemical is ingested, it can be harmful; however, exposure has been deemed highly unlikely in this area due to a lack of public wells and the chemicals' unlikelihood of transportation to area springs. The plume is contained on site.

Currently, no detectable exposure to hazardous chemicals from the site is occurring, but the possibility exists for future exposure.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Syntex - Verona (West)

Site Name: Syntex - Verona (West)

Classification: Class 3

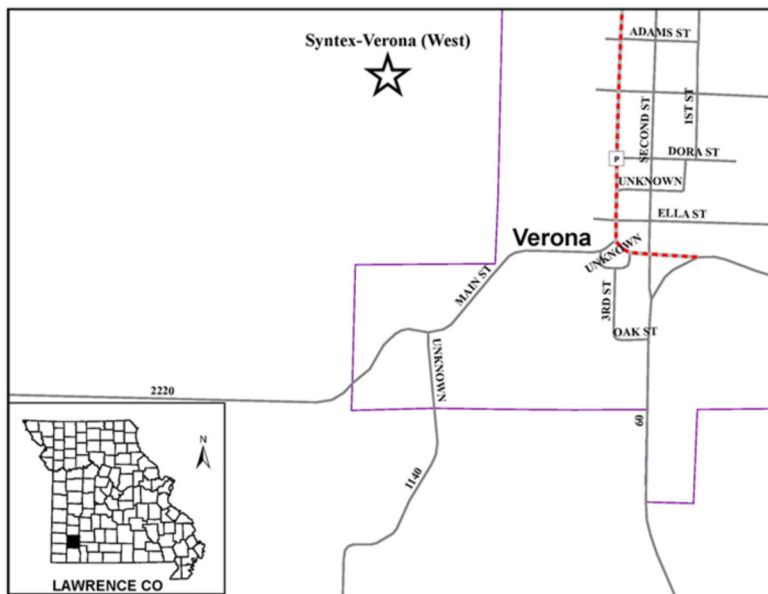
Date of Registry Placement: January 1, 1984

Date of National Priorities List Listing: September 8, 1983

Site Address: 299 Extension Street, Verona, Lawrence County, MO

Present Property Owner: Syntex Agribusiness, Inc.

Lead Agency: U.S. Environmental Protection Agency (EPA)



Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description and Environmental Concern:

The Syntex – Verona (West) site is a tract of undeveloped land west of the Spring River in Verona, Missouri. The site contains a trench area upgradient from the Spring River on a topographical high. The trench area contains buried materials, some of which contain 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin).

The privately owned site is heavily wooded and encompasses approximately 80 acres. The trench area is grassy and encompasses approximately 1.3 acres. Rural residences are located more than 0.5 mile from the site. The perimeter of the trench area remains secured with a barbed-wire fence and gate.

From approximately October 1966 to April 1971, Syntex disposed of scrap paper, metal, and off-specification manufacturing wastes within the trench area. The site is inactive, except for sampling of monitoring wells.

U.S. Environmental Protection Agency (EPA) investigations around the trench area delineated the nature and extent of chemicals of concern. Remediation of the trench area included installation of a protective cap and a drainage interception channel. EPA conducts Five-Year Reviews (FYRs) of the site to monitor the protectiveness of the remedy.

Remedial Actions:

Contractors for Syntex constructed a clay cap to promote drainage away from the trenches in the trench area. Contractors subsequently placed topsoil on the cap and established vegetative cover. In addition, Syntex installed an upgradient gravel trench to divert storm water away from the trenches. Syntex installed groundwater monitoring wells to monitor groundwater quality at the trench area.

Syntex sold an uncontaminated 80-acre tract west of the trenches. The company retained the required buffer area and established permanent survey markers around the site as required by registry law. A fence and warning signs restricting access also are present around the trench area. Syntex continues to operate a monitoring system for shallow groundwater downgradient of the trench area. Contaminants are not leaving the site.

After Syntex implemented remedial actions for soils, groundwater, and surface water, EPA determined that the site conditions were protective of human health and the environment. However, the two most recent FYRs, conducted by EPA in 2012 and 2017, concluded that the overall protectiveness of the remedy could not be determined without additional information. This is due to changes in the risk assessment methodology, assumptions, and toxicity values that occurred after selecting the remedy.

In September 2016, to address the issues identified in the 2012 FYR, Syntex entered into an Administrative Order on Consent (AOC) with EPA. The AOC's purpose was to direct Syntex to perform additional site investigations so that EPA can determine whether the remedy remains protective. The additional investigations include: soil, sediment, and groundwater sampling; monitoring well installations; and, hydrogeological and geotechnical characterization. The 2016 AOC also included reassessment of human health and ecological risk using current methodology, assumptions, and toxicity values.

In 2017, with EPA oversight, Syntex began conducting the additional site characterization and risk assessment described in the AOC. EPA will continue to oversee Syntex's work to satisfy the AOC's requirements to address any data gaps. This work will continue until the remaining questions can be resolved and EPA can adequately evaluate the remedy's protectiveness of human health and the environment.

In 2019, EPA held two public availability sessions and participated in an open city council meeting to provide updates to the community about ongoing site activities performed by Syntex under the 2016 AOC. Also in 2019, EPA initiated a large-scale, domestic drinking water well sampling program in response to investigations that identified 1,4-dioxane in the groundwater at the site and to address the public's concern that site contaminants might be present in their domestic drinking water wells. 1,4-Dioxane is soluble in water and does not readily biodegrade in the environment. In December 2019 and January 2020, EPA sampled more than 90 domestic wells serving residences and a church within 2 miles of the site.

EPA analyzed the water samples for 1,4-dioxane, as well as for other semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), dioxins, and dioxin-like compounds. EPA also sampled one small public water supply for 1,4-dioxane. 1,4-Dioxane was detected at low levels consistently in one domestic well, and at very low levels – near the laboratory detection limit – in two other domestic wells. EPA determined there were no impacts to the domestic wells by site-related contaminants above the relevant EPA health-based standards.

In 2020, Syntex replaced a portion of the western property boundary fence, including the trench area buffer zone, with a tall woven-wire fence. On Dec. 9, 2021, EPA held a public availability session in Verona, to update the public on recent site activities, as well as to announce they will conduct the next FYR.

On April 13, 2022, an Environmental Covenant (EC) covering the Syntex facility site's West Area went into effect. The EC includes requirements for maintenance of the trench area existing cap, fence (to include signage), and survey markers; establishment/maintenance of a boundary fence with signage; restrictions on groundwater use or well installation; and, building restrictions.

The Department completed the Fiscal Year 2022 Registry annual inspection on June 28, 2022, and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located in an upland area not subject to flooding by the Spring River. Soil beneath the trench area and in the surrounding upland area consists of cherty silt and clay that overlies bedrock and ranges from about 40 to 60 feet thick. Shallow groundwater occurs at or near the soil/bedrock interface, approximately 30 feet below the bottom of the trenches.

Two bedrock aquifers are present at the site: the shallow Mississippian limestone aquifer called the Springfield Plateau Aquifer, and a deeper aquifer made up of Cambrian- and Ordovician-age carbonates and sandstones called the Ozark Aquifer.

The Springfield Plateau Aquifer is made up of cherty limestone that directly underlie the surficial materials. This aquifer supplies limited yields to shallow wells and is subject to contamination from local sources, such

as septic tanks and agricultural runoff, either through permeable soil and bedrock or through poorly-cased wells.

The Ozark Aquifer, present typically at depths greater than 300 to 400 feet, supplies water to major industrial and municipal users, and individual landowners in the area. In general, the Ozark Aquifer in this region of the state has not been affected greatly by surface contamination; however, some localized pollution has resulted because of poorly-cased deep wells penetrating both the upper and lower aquifers.

Public Drinking Water Advisory:

The closest public water well to this site lies 0.7 miles east of the site boundary and serves a small subdivision. The well is cased to 360 feet deep, draws from the deep Ozark Aquifer, and site-related impacts are unlikely. The combined Aurora-Verona public water system also uses deep wells to draw water from the Ozark Aquifer, but the closest well to this site is more than 2 miles to the east-northeast. No site-related impacts are expected.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Potential routes of exposure include direct exposure to the contaminated soil or inhalation of contaminated dust. Overland access to the trench area is possible, but property boundaries are fenced and “No Trespassing – Restricted Area” signs are posted. Syntex has improved roadways at the site; a majority of the roads are now paved with asphalt and others have a crushed-rock cap. These improvements allow safer access to monitoring wells and eliminate disturbance of surface soils. The outline of the trench area cap is marked, posted, and surrounded by a barbed-wire fence. Heavy vegetation limits access along the Spring River. Syntex capped the waste materials, as outlined above, to prevent exposure. Shallow groundwater at the site is not accessible. The Department of Health and Senior Services considers fish in the Spring River safe to eat, because sampling has shown that TCDD levels are no longer of health concern.

In December 2019 and January 2020, EPA sampled more than 90 domestic wells serving residences and a church within 2 miles of the site. These domestic drinking water wells were sampled for 1,4-dioxane, other SVOCs, VOCs, dioxins, and dioxin-like compounds. This sampling event did not identify any wells impacted above health-based standards. Risk of exposure at this site is minimal, as long as the trench and waste area caps remain intact. This site does not pose a significant public health risk at this time.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Tillman House

Site Name: Tillman House

Classification: Class 3

Date of Registry Placement: September 24, 2001

Site Address: Tillman Road near Highway OO and T, approximately 9 miles south of Farmington, St. Francois County, Mo.

Present Property Owner: Douglas Beard & Allison Barrett

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene, acetone, volatile organic compounds (VOCs)

Quantity: Not determined

Site Description and Environmental Concern:

The Tillman House site is the location of the former North American Airborne Allergens, Inc. (NAAA). From 1975 until 1989, the former facility used tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene, acetone, and volatile organic compounds (VOCs) to process pollens for pharmaceutical use. Site operations may have included burning PCE and acetone with trash.

The privately-owned site consists of 15-acres in a rural setting with several structures, including the historic Tillman House, a foundation from the former Weidert house, and a metal shed. An unnamed intermittent stream flows through the center of the property and into the Little St. Francis River at the site's northwest corner. Private agricultural residences surround the site.

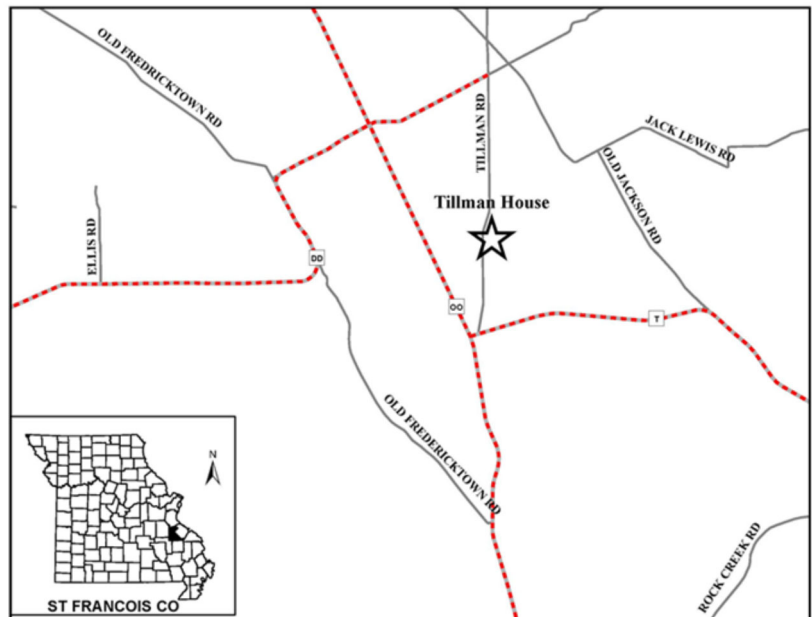
NAAA's pollen processing left soil and surface water contaminated with PCE. Sampling located spilled PCE in groundwater and surface water at concentrations up to 1,640 parts per billion (ppb). TCE is present in groundwater at concentrations above a level of health concern.

1999 sampling showed TCE and PCE surface water concentrations above a level of health concern, leaving potential exposure to contaminated water in the stream a human health risk.

Remedial Action:

In 1996, a U.S. Environmental Protection Agency's (EPA) contractor conducted a Preliminary Assessment/ Site Inspection investigation and recommended a removal action due to the presence of PCE and TCE in the on-site private drinking water well (Weidert well) above the maximum contaminant level of 5 ppb. To address this contamination, EPA installed a carbon filtration system for the drinking water well. The investigation also found that soil samples contained PCE.

According to the former property owner, Mr. Lindell Clubb, the Weidert well dates back to 1941. It was approximately 200 feet deep and only cased to 10 feet deep. In 1998, Mr. Clubb had a new well drilled to serve his home, the Tillman House. The new well was 307 feet deep and had 80 feet of casing. The Missouri



Department of Health and Senior Services (DHSS) tested the well in 2007, 2009, and 2011. DHSS did not detect VOCs above the maximum contaminant level.

In 1999, the Department conducted a Site Reassessment investigation because the DHSS samples from the old Weidert well showed TCE levels above the maximum contaminant level after the carbon filtration system. This was due to the owner not changing or replacing the filter. The Department took surface water samples from the pool of the on-site intermittent stream and at the confluence of the intermittent stream and the Little St. Francis River. The surface water contained PCE above the maximum contaminant level and Missouri Water Quality Standards benchmarks. However, concentrations decreased to below levels of concern approximately 250 feet downstream of the confluence with the Little St. Francis River.

In October 2005, Mr. Clubb had another well drilled on the southern part of the property. This well was 287 feet deep with 80 feet of casing. It is located approximately 300 feet west of the old Weidert well. DHSS tested this new well five times, starting in 2006. The first results detected PCE at 4.8 ppb in November 2006. When sampled again in April 2007, results detected PCE at 1.2 ppb. Results from the last three tests in May 2008, August 2009, and November 2011, showed no VOCs detected.

The Department recommended that the old contaminated Weidert well be properly closed and abandoned. This action would cut off the route of exposure to contaminated drinking water and most likely eliminate a contaminant pathway to deeper groundwater. In August 2011, the Department oversaw the Weidert well's proper closure. No further remedial actions have occurred since then.

On June 14, 2022, the Department conducted the Fiscal Year 2022 annual inspection and noted nothing of significance in the inspection report.

General Geologic and Hydrologic Setting:

The Tillman House site is located on the eastern fringe of the Salem Plateau portion of the Ozark Plateau physiographic province, situated on a gently rolling surface. An intermittent creek crosses the site from the east to the northwest where it enters the Little St. Francis River.

The Cambrian-age Bonnetterre Formation underlies the site and is composed of dolomite characterized by a pinnacled erosional surface. The Bonnetterre Formation is overlain by about 10 feet of silt and silty clay (loess), and clayey materials. Examples of minor karst, such as losing streams, seeps, and springs, are reported near the site. Large joints (bedrock fractures) observed in bedrock exposed in the Little St. Francis River may be related to underlying geologic structures (Libertyville Graben) and more distant northwest–southeast trending fault zones.

The Cambrian-age Bonnetterre Formation and the underlying Lamotte Sandstone form the St. Francois Aquifer. In areas like the eastern part of the Ozark province, adjacent to the east side of the St. Francois Mountains groundwater province (also the recharge area for the St. Francois Aquifer), the St. Francois Aquifer is the only local source of groundwater available and, therefore, important. The water table is approximately 10 feet below the ground surface near the contact between soil and bedrock. Joints may control the direction of groundwater flow, but it is generally toward the northwest with discharge occurring to the Little St. Francis River.

The intermittent creek, which crosses the site, enters the westward flowing Little St. Francis River, which continues to flow to the west then turns south where it joins the St. Francis River. The St. Francis River eventually empties into the Mississippi River in eastern Arkansas.

Public Drinking Water Advisory:

No public water sources are located within 5 miles of this site, and no impacts are expected.

Health Assessment:

Contaminants found at the site include PCE, acetone, TCE, and 1,2-dichloroethene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

DHSS sampled private drinking water wells in the nearby vicinity in 2004 and 2012 and did not find any VOC impacts.

Based on available information, surface water could be a source of exposure to the contamination. In 1999, the Department completed the last sampling of the creek. Until new sampling can be completed, it is unknown if the creek is still contaminated.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Todd Site

Site Name: Todd Site

Classification: Class 3

Date of Registry Placement: June 2, 1987

Site Address: 701 Lynch St., St. Louis, St. Louis City, MO

Present Property Owner: Anheuser-Busch Companies, Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Stoddard solvent

Quantity: During remediation, Anheuser-Busch Companies Inc. (ABC) removed a total of 26 underground tanks and eight 55-gallon drums, containing a combined 54,405 gallons of liquids and sludges, and 4,236 cubic yards of contaminated soil.



Site Description and Environmental Concerns:

The Todd site is the location of a former commercial laundry and dry-cleaning business that stored Stoddard solvent in underground storage tanks. Today, the site is a privately owned paved parking lot for the Anheuser-Busch Companies Inc. (ABC), which has its headquarters nearby in downtown St. Louis. It is located in a light industrial area with residential properties less than 1 mile away.

A commercial laundry and dry-cleaning business operated on the site until 1980. ABC purchased the property in 1980 and in 1983, razed the buildings and paved the site for use as a parking lot.

Following remedial actions, residual contamination remains in the soil and groundwater. Contamination may be migrating off site via groundwater. However, city ordinance prevents groundwater use in St. Louis as a potable water supply, therefore limiting potential exposure.

Remedial Actions:

Sampling and analyses of the underground tanks indicated the presence of Stoddard solvent, which possesses the characteristic of an ignitable hazardous waste. On Oct. 7, 1983, five groundwater monitoring wells were installed. Analyses of groundwater samples collected from these wells showed the presence of Stoddard solvent downgradient from tanks at the site's west side. Laboratory analysis did not detect this contaminant in groundwater samples collected upgradient from those tanks. On Feb. 6, 1984, the Department notified ABC of its intention to include the Todd site on the Registry. On March 2, 1984, ABC appealed the proposed Registry action. On Sept. 6, 1985, the Hazardous Waste Management Commission heard ABC's appeal and entered an order denying ABC's appeal and directing the Missouri Department of Natural Resources (Department) to include the Todd site on the Registry. In October 1985, ABC filed another appeal to the Cole County Circuit Court; in March 1987, the circuit court upheld the commission's decision to place the site on the Registry.

On May 25, 1984, the Department issued ABC a Notice of Order to Clean up Hazardous Substance (Order No. HC84-003). The Department required ABC to implement a Department-approved Remedial Action Plan. The Remedial Action Plan addressed three areas of the Todd site: west side, Todd building area, and dry-cleaning area.

ABC's contractor, Environmental Science and Engineering, Inc. (ESE), excavated 18 tanks, and contaminated soil from around the tanks, from the site's west side (Area 1). ESE found that two of the tanks contained diesel oil and sludge, while the remaining tanks contained Stoddard solvent, sludge, or contaminated soil. ESE shipped these liquid wastes to an off-site hazardous waste landfill for solidification and land disposal. ESE shipped the tanks and 4,236 cubic yards of contaminated soil off site for landfilling. Soil sample results from the excavated pit ranged between 20 and 11,000 parts per million (ppm) for Stoddard solvent. ESE filled the excavated area with clean soil.

The Todd building area (Area 2) contained seven underground tanks. Area 2 was located at the corner of Lynch and Seventh streets. ESE shipped the liquid contents of these tanks (essentially Stoddard solvent) off site for recycling. ESE shipped sludge from the tanks to an off-site hazardous waste landfill for disposal. ESE cleaned and filled five of the empty tanks with concrete, and excavated the two remaining tanks and shipped them to a landfill.

The dry-cleaning area (Area 3), immediately north of the Todd building, consisted of a sump containing gravel, solvents, and water, as well as a large tank containing solvents and water. ESE addressed the tank by pumping it out, cleaning it, and filling it with sand. ESE shipped the solvents from the sump and tank off site for recycling, and sent the sludge off site for disposal in a hazardous waste landfill. ESE also shipped eight 55-gallon drums of dry-cleaning sludge off site for landfill disposal.

Following these actions, ESE collected samples from the five monitoring wells, which showed the presence of Stoddard solvent in downgradient wells at concentrations of up to 32.3 ppm. The recommended water cleanup level was 2.3 ppm. In addition, sample analyses confirmed the presence of a top layer of Stoddard solvent in a third monitoring well. A sample collected from this well Dec. 10, 1984, contained a layer of Stoddard solvent with a 1,3,5-trimethylbenzene concentration of 10,000 ppm. ESE properly plugged the five monitoring wells during construction of the parking lot on the west side.

On May 3, 2022, Department personnel conducted the Fiscal Year 2022 annual site inspection, during which inspectors reported no significant changes at the site.

General Geologic and Hydrologic Setting:

The site is located on a moderate slope, which forms the western edge of the Mississippi River alluvial plain. Environmental consultants working at the site noted that surface soils contain fill material consisting of firm, brown, silty clay, intermixed with construction rubble. Silty clay underlies the fill, which is generally between 3.5 and 4.5 feet thick.

The bedrock unit beneath the site is Mississippian-age St. Louis Limestone, a medium- to massively-bedded, fine-grained limestone that is greater than 100 feet thick. The St. Louis Limestone contains well-developed karst features. The bedrock in this area is highly permeable as a result of dissolution along fractures and bedding planes. Beneath the St. Louis Limestone is more than 700 feet of Mississippian, Silurian, and Devonian bedrock, predominantly limestone, which forms the uppermost bedrock aquifer. The Ordovician-age Maquoketa Shale separates the upper, freshwater aquifer from the saline water of deeper Ordovician and Cambrian formations.

Shallow soil-exploration borings drilled on the site indicate some free water at about 15 feet below the surface. This water may be perched on top of one of the moderate- to low-permeability, silty, clay deposits. The direction of the perched water's movement is unknown. The water table elevation at the site also is unknown, but geologists have estimated it to be 40 to 50 feet below the ground surface. Geologists expect that the shallow groundwater's general direction of movement is eastward toward the Mississippi River, which serves as a regional discharge point. The rate of groundwater movement should be slow to moderate in the soil horizons and rapid in the bedrock.

Groundwater generally is not used as a water supply source in St. Louis, because surface water supplies have been well developed. However, various drilling companies have developed wells in the downtown area, and some of these may still be in use.

Public Drinking Water Advisory:

The city of St. Louis draws water from the Mississippi and Missouri rivers, with intakes located several miles upstream from this site. No public water sources in the vicinity use groundwater. No site-related impacts are expected.

Health Assessment:

The chemical of concern at this site is Stoddard solvent. The chemical composition of a typical Stoddard solvent is 30 to 50 percent paraffins, 30 to 40 percent cycloparaffins, and 10 to 20 percent aromatic hydrocarbons. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant. At present, the risk to public health is minimal, since groundwater in this area is unsuitable for drinking purposes.

Based on available information, a potential health risk remains at the site due to the known concentrations of the contaminants in the soil and water. Current risks are low, as long as the area remains paved and no one uses the groundwater for drinking.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

University of Missouri - South Farm

Site Name: University of Missouri - South Farm

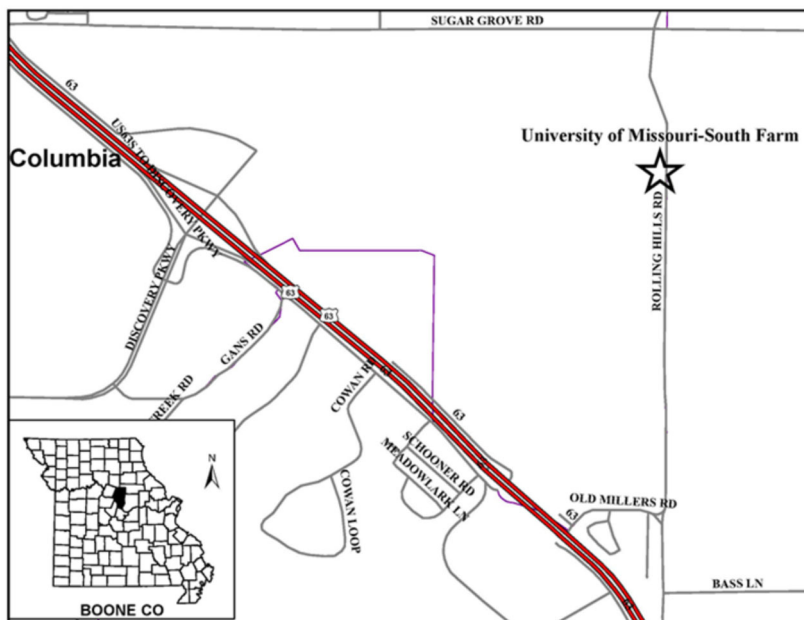
Classification: Class 3

Date of Registry Placement: January 1, 1984

Site Address: West side of Rolling Hills Road, 0.4 mi. south of E. Sugar Grove Rd., southeast of Columbia, Boone County, Mo., NE 1/4, SE 1/4, NW 1/4, Sec. 34, T48N, R12W, Columbia Quadrangle

Present Property Owner: University of Missouri

Lead Agency: Missouri Department of Natural Resources (Department)



Waste Type: Laboratory wastes, waste solvents, farm chemicals, and radioactive waste

Quantity: Undetermined amounts of waste, because wastes were subject to open burning and only residues remain

Site Description and Environmental Concern:

The University of Missouri - South Farm site is a burial site for agricultural and lab chemical wastes from the University of Missouri (University). From 1966 to 1978, the University burned and buried a wide variety of chemicals from the farm's operations and from campus laboratories. Buried chemicals at the site included pesticides, metals, hydrocarbon and chlorinated solvents, laboratory chemicals, and low-level radioactive wastes (C-14 and tritium), resulting in soil and groundwater contamination.

The site is located on the University's South Farm along the west side of Rolling Hills Rd. and just south of Gans Creek. The University owns the site and surrounding property. Although the site was located in rural Boone County at the time of disposal, recent development has made the site part of a rural residential area. No homes are immediately adjacent to the site; however, a house is located within 0.1 mile. No structures are on site. The entire farm is fenced to limit public access, and the disposal site is fenced to prevent access by livestock. Signs identifying the site as a "Chemical Disposal Area" and warning "Keep Out" are on the gate and the fence. The site lies within pastureland used for agricultural research at the South Farm. The land slopes gently to the northwest toward Gans Creek, which lies about 300 feet from the burial site.

Environmental concerns include the burned waste residue, contaminated soil, and shallow groundwater contamination. The Missouri Department of Natural Resources (Department) found a wide variety of chemicals in the soil in the disposal trenches, and a dissolved plume of solvents migrating in shallow groundwater about 150 feet northwest of the burial site.

Remedial Actions:

In 1991, the Department completed a Site Inspection, which concluded that hazardous substances were present in the buried trenches and that shallow groundwater contamination was occurring. The chemical herbicides 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) were detected in water samples taken from the on-site borings.

In 1997, the University applied to the Department's Brownfields/Voluntary Cleanup Program to further

characterize the site and determine the need for remediation or monitoring. In 2000, the University installed three new bedrock-monitoring wells and additional overburden wells to assess migration of the wastes from the burial site. The University conducted quarterly groundwater monitoring through early 2002 to establish a baseline and observe trends in groundwater quality.

Surface water and sediment samples collected from Gans Creek showed no detectable contaminants discharging to the creek. Surface soil samples collected from the burial area showed no detectable contaminants. Shallow groundwater samples from temporary monitoring points contained 13 volatile organic compounds (VOCs), including dichloroethane, benzene, chlorobenzene, and chloroform. Sampling detected lower levels of 17 VOCs and chlorinated herbicides in shallow bedrock monitoring wells at water level depths of 13 to 37 feet below ground level. The solvent 1,4 -dioxane was the only detected contaminant in the farthest downgradient well, closest to Gans Creek. Due to its solubility and mobility, 1,4-dioxane would be expected to migrate more quickly than the other contaminants. At this time, there is no evidence that the contaminants are reaching any receptors, including Gans Creek or drinking water wells in the area.

In 2013, the University began new investigations of soil and groundwater. The University collected soil and buried waste samples by means of soil borings and exploratory trenches. It also collected water samples from Gans Creek. It installed several new monitoring wells, abandoned some wells, and replaced them to better assess the groundwater plume. The University conducted quarterly sampling of all wells through July 2015.

In December 2015, the Department received a report on the investigations. New soil data helped to better characterize concentrations of pesticides, solvents, and metals at the site. The data confirmed that surface soil contamination is minimal within the fenced burial area. Sampling detected a wide range of chemicals at parts-per-million levels in subsurface soil around and within the waste trenches, but no large deposits of chemical wastes.

Groundwater data indicated the plume extends approximately 300 feet from the burial area and remains contained to the area between the burial site and Gans Creek to the northwest. Based on groundwater sampling, as well as sampling of both water and sediment, the plume does not appear to be affecting Gans Creek. The report recommended the plume be contained to prevent further migration to the north and west of the burial site. In 2017, the Department requested the University to perform feasibility studies for containment or removal of the burial area, and to conduct studies to evaluate the treatability of the groundwater plume.

The University has a Nuclear Regulatory Commission (NRC) license for the site, due to the disposal of carbon-14 and tritium. In 2020, the University applied to NRC to discontinue its license, based on the very low levels of radioisotopes remaining at the site. As part of that application, the University submitted a risk assessment to NRC for review. The U.S. Environmental Protection Agency (EPA) and the Department submitted comments on the risk assessment, and are awaiting NRC's final ruling. If NRC were to discontinue the license, management of all the materials at the site, including radionuclides, would continue under Department oversight.

On April 12, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located on a west-facing, moderately gentle slope. Gans Creek, which occupies the valley downslope, flows to the southwest and through Rock Bridge Memorial State Park. It eventually merges with Clear Creek to form Little Bonne Femme Creek, which then enters the Missouri River.

The soil underlying the site consists of a relatively thin layer of silt and silty clay of glacial origin. The total soil thickness above bedrock is estimated to be 8 to 20 feet. Bedrock in the immediate vicinity is composed of Pennsylvanian-age cyclic deposits of sandstone, siltstone, shale, underclay, limestone, and coal. This bedrock, which is expected to be 20 to 40 feet thick, probably has low permeability.

Groundwater is obtained from two major bedrock aquifers in this area. The shallow bedrock aquifer, composed of Mississippian limestones, underlies the Pennsylvanian bedrock and provides low yields to private wells. The deep aquifer, composed of Cambrian- and Ordovician-age carbonates and sandstones,

is isolated from the shallow aquifer by a thin layer of Devonian limestone, which acts as a "leaky" confining unit. The deeper aquifer is used as a public water supply source and for other uses that require high yields. Poorly-cased wells may provide an avenue of downward migration for contaminants.

The low permeability of the glacial soil and overall low permeability of the Pennsylvanian bedrock are expected to prevent deep groundwater from being affected. Shallow, perched groundwater possibly exists in the glacial soil or at the top of the bedrock. Perched water is expected to move horizontally, reappearing downslope and potentially affecting surface water in the Gans Creek watershed.

Public Drinking Water Advisory:

Consolidated Public Water Supply District #1 of Boone County uses a deep well located approximately 1.1 miles south-southwest of this site. This well is cased to over 300 feet deep and is not likely to be impacted by site-related contamination.

Health Assessment:

The University burned and buried a wide variety of chemicals, including pesticides, hydrocarbon and chlorinated solvents, laboratory chemicals, and low-level radioactive wastes (C-14 and tritium) at the site. Due to the large number of chemicals involved, it is difficult to provide a comprehensive list of specific health effects from exposure. Exposure to many of the chemicals can cause both cancer and non-cancer health effects.

Exposure is only likely to occur through ingestion of contaminated groundwater. Residential development of land adjacent to the site is occurring at an increasing rate. However, no residences within 3 miles are known to use groundwater for drinking water. Public water is available for the area surrounding this site. The Missouri Department of Health and Senior Services (DHSS) has not discovered evidence of groundwater use near the site. The University capped the entire area used for waste disposal. Most of the site is well vegetated. As long as the University maintains the cap, DHSS does not consider contact with contaminated soil to be a potential route of exposure.

Sampling on-site subsurface soils, surface soil, and groundwater showed detections of pesticides, solvents, and metals. Although the groundwater contamination plume remains on site, the geologic and hydrologic setting at the site makes it possible for contaminated groundwater to migrate downslope and potentially affect the surface water of the Gans Creek watershed. Based on available information, this site represents a possible human health threat, with on-site workers being at greatest risk, although no exposure exists at this time.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

CLASS 4 SITES

A. P. Green

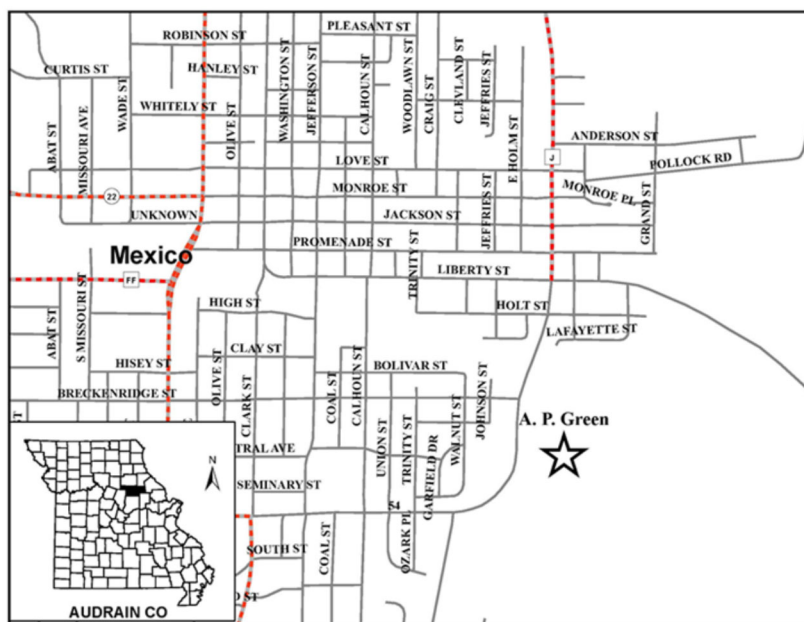
Site Name: A.P. Green

Classification: Class 4

Date of Registry Placement: June 14, 1984

Site Address: Green Boulevard, Mexico, Audrain County, Missouri, Vandalia Quadrangle. The site consists of six individual waste dumps with the following location descriptions:

- (1) Waste Dump No. 2, SW 1/4, SE 1/4, Sec. 31, T51N, R8W
- (2) Waste Dump No. 4, SW 1/4, SE 1/4, Sec. 31, T51N, R8W and portions of NW 1/4, NE 1/4, Sec. 6, T. 50N, R.W
- (3) Dynamite Dump No. 5, N 1/2, NE 1/4, Sec. 6, T50N, R8W
- (4) Waste Dump No. 6, NE 1/4, NW 1/4, Sec. 6, T50N, R8W
- (5) Waste Dump No. 7, SE 1/4, NW 1/4, and portions of the SW 1/4, NE 1/4, portions of NW 1/4, SE 1/4, and portions of NE 1/4, SW 1/4, Sec. 6, TN, R8W
- (6) Waste Dump No. 8, NW 1/4, SW 1/4, Sec. 31, T51N, R8W



Present Property Owners: Environmental Liability Transfer (ELT)

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Dynamite (nitroglycerine) and cyanide-containing heat-treating compounds

Quantity: Estimated 5,000 pounds of dynamite and undetermined quantity of cyanide compounds remain buried on-site

Site Description and Environmental Concern:

The A.P. Green Site is the location of six separate former clay mining pits associated with the A.P. Green Fire Brick Company, a refractory brick manufacturing business. A.P. Green originally mined the six pits, designated Waste Dump (WD) #2, WD#4, WD#5, WD#6, WD#7 and WD#8, to provide clay for the production of refractory bricks. After mining ceased, records indicate A.P. Green used six of the pits for disposal of various heat-treatment wastes, including cyanide- and nitroglycerine-containing wastes, between 1954 through 1981. The buried nitroglycerine (dynamite) in one of the pits is the primary concern. The company buried approximately 150 gallons of nitroglycerin- and cyanide-containing wastes between 4-40 feet deep in pits WD#2, WD#4, WD#5, WD#6, and WD#7. In addition, the company deposited about 5000 pounds of nitroglycerin in pit WD#8.

The site was part of the A.P. Green Fire Brick Company, which occupied 900 acres and manufactured refractory bricks between the early 20th century and 2002, when the factory closed. Since then, the property owner subdivided the land and sold the parcels to various buyers.

Currently, the ground surface is heavily vegetated. A gated fence restricts access to the parcels containing the pits. The site has warning signs posted. The closest residence is 1,300 feet away, and the nearest commercial or industrial area is 0.5 mile to the north. A publicly-traveled roadway, US Highway 54, is 800 feet away, and a public-use area, Teal Lake Park, is 0.5 mile away. Numerous ponds and streams are in the

area.

The buried dynamite (nitroglycerine) in one of the pits is the primary concern. Dynamite is composed of nitroglycerine, sorbents such as clay, and stabilizer compounds. While backfilled with clay soils, stormwater may infiltrate the pits, potentially reaching buried contaminants. Due to the regional geology, the Missouri Department of Natural Resources (Department) anticipates minimal potential migration of contaminated groundwater from the pits. However, the stability or explosive life of the buried dynamite is unknown. Worker injury, fire, or explosion could occur if the waste is disturbed.

Further, one of the pits was part of a permitted demolition landfill. Two additional waste dump pits associated with A.P. Green operations are located in the same area; however, these are not listed on the registry because the Department could not confirm if these pits received hazardous wastes for disposal. Records indicate that one pit received asbestos and the other received metal piping used for acid transfer.

Remedial Actions:

In 1981, the Department conducted a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection (SI). The pits already had been covered with soil at that time. The SI concluded that the site poses low risk to human health and the environment. The Department's SI identified disturbance of the buried wastes as the primary potential health risk. No further investigation or remedial action has occurred at the site.

Following registry notification in 1986, the property owners, Environmental Liability Transfer (ELT), submitted a legal survey to reduce the size of the property appearing on the registry. The owners installed survey markers at the corners of the six contaminated pits, including a 100-foot buffer zone in all directions. In 2019, ELT confirmed they were interested in pursuing an Environmental Covenant (EC) in exchange for removal from the registry. The Department is in the process of signing and requesting the Audrain Recorder of Deeds to record the EC.

On July 26, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which inspectors observed that the survey markers for each of the capped areas were present. The annual inspection report noted that the caps on the waste disposal areas appeared to be in good condition, but the property is heavily overgrown with vegetation, primarily western red cedar.

General Geologic and Hydrologic Setting:

The site is located in an upland setting. Glacial till, about 100 feet in thickness, overlies Pennsylvanian-age bedrock. Both the surficial material and the bedrock are characterized by low permeability.

Shallow groundwater is present in the glacial till, though yields generally are low. The approximate location of the water table is at the contact between the surficial material and the bedrock. Groundwater found at this depth does not meet drinking water standards, because it typically is highly mineralized.

Due to the surficial material's low permeability, numerous natural ponds exist in the area. In addition, clay pits in the area retain water, creating artificial ponds. Streams in this region tend to be gaining.

Site contamination is not likely to significantly impact groundwater supplies. However, leakage from the pits may affect surface waters if it reaches Long Branch Creek to the east or South Fork of the Salt River to the west.

Public Drinking Water Advisory:

The closest public water well belongs to the Missouri American Water - Mexico District, but is located 2 miles west of this site. This well, and other wells belonging to the system, have casing more than 400 feet deep and draw from the northern margin of the Ozark aquifer. No impacts are expected.

Health Assessment:

The chemicals of concern include cyanide and nitroglycerine. Please refer to the Health Assessment

Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The parcels where the individual pits are located are restricted from public use, and the materials are buried at depths from 6 to 40 feet. The Missouri Department of Health and Senior Services (DHSS) concluded that, because of the massive clay deposits surrounding and underlying the site, the potential for off-site chemical migration through groundwater movement is very small. WD#7, used for disposal of dynamite, is located within a high-voltage overhead electric line easement. This could pose a safety threat to persons performing work in the utility line easement if the work were to involve excavation. Otherwise, the only likely exposure to these chemicals appears to be if the wastes were disturbed or erosion were to occur. This could result in adverse health effects through ingestion or dermal absorption of contaminants by contact with buried waste or localized contaminated soil and groundwater.

Direct exposure to on-site contamination is unlikely. A historical exposure investigation conducted by DHSS found no evidence of human exposure to on-site contaminants.

Based on available information, DHSS has determined that this site does not currently pose a health hazard to the general population. Similarly, workers and trespassers on the site should not be at risk, provided the integrity of the cap is maintained and waste materials are not disturbed; however, DHSS recommends that the clay around the pits be maintained to reduce water pooling and soil erosion.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Armco

Site Name: Armco

Classification: Class 4

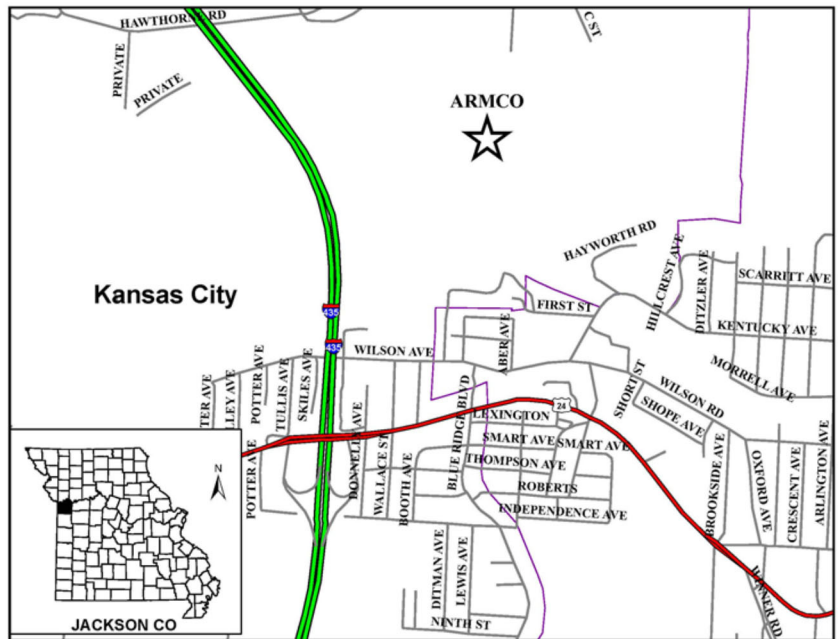
Date of Registry Placement: January 1, 1984

Site Address: 7000 Winner Road, Kansas City, Jackson County, MO
Portions of SW 1/4, Sec. 29; NW 1/4, Sec. 32; and NE 1/4, Sec. 31, T50N, R32W, Independence Quadrangle

Present Property Owners: The Kansas City Port Authority

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Arsenic, cadmium, chromium, lead, and zinc



Quantity: Approximately 27,000 tons of baghouse dust remains in the closed landfills

Site Description and Environmental Concern:

The ARMCO site complex is an inactive steel manufacturing plant that disposed of electric furnace baghouse dust generated from steel production processes on site. Baghouse dust contained leachable quantities of lead and cadmium and a high concentration of zinc (10-12%).

Approximately 411 acres of the site are publicly or municipality owned; the remaining 370 acres are private property. The site is located in an industrial area of Kansas City, with the nearest residence located approximately 400 feet to the west. The Missouri and Blue rivers border the property on the north. The Kansas City Port Authority restricts access to the site by fencing, but there is access by water via the Blue and Missouri rivers. The BNSF railroad borders the property on the south. Industrial activities occurred exclusively in the area west of I-435, while the land east of I-435 is largely undeveloped. The current and anticipated future land use at the property is non-residential.

The site is no longer an active steel manufacturing plant; steel manufacturing occurred from 1888 to 2001. ARMCO placed baghouse dust, generated from steel production processes, in two on-site landfills between 1962 and 1980. ARMCO closed the Old Blue River "W" Landfill in 1980, leaving the waste in place. After 1980, the Resource Conservation and Recovery Act (RCRA) provided regulation for these waste types. ARMCO closed the RCRA Landfill in 1984, leaving waste in place. ARMCO capped these landfill areas with 3 feet of soil and vegetative cover. The registry lists both landfill areas.

ARMCO conducted groundwater monitoring at the RCRA Landfill under a Missouri Department of Natural Resources (Department)-issued permit. Groundwater monitoring indicated that contaminants from wastes left in place were not leaching from the landfill. In 1998, the Department approved a permit modification to discontinue groundwater monitoring of the RCRA Landfill.

Remedial Actions:

EPA issued a Hazardous and Solid Waste Amendment Part II Permit on Nov. 30, 1994, requiring the permittee to conduct site-wide corrective action. The Department, under a Jan. 11, 1994, Part I Missouri

Hazardous Waste Management Facility Permit, permitted the RCRA landfill. EPA's Part II Permit required corrective action at 20 solid waste management units (SWMUs) and four areas of concern (AOCs). These units and AOCs are on property owned by: the Kansas City Port Authority; Ross Custom Properties, LLC; Blue Summit LLC; The Andersons Inc.; Hansen Property Development Inc.; and, Planned Industrial Expansion Authority.

To assess potential releases to the environment from the SWMUs and AOCs, AK Steel Corporation conducted a RCRA facility investigation in 1999 and a supplemental RCRA facility investigation in 2008. EPA and the Department approved both documents Feb. 3, 2009.

In 2013, AK Steel conducted an investigation of suspected historical mercury disposal at a former boiler house on the ARMCO site. In March 2016, AK Steel removed and properly disposed of mercury-contaminated soil.

In 2015, AK Steel prepared and submitted a final Corrective Measures Study Report for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33, and for AOCs 1, 4, and 8. EPA and the Department approved the document July 22, 2016.

In September 2017, AK Steel completed interim measures at SWMU 33, Nail Mill Degreasing Area. Interim measures consisted of removing and properly disposing of trichloroethene-contaminated soil. On Dec. 6, 2017, AK Steel submitted a long-term monitoring plan consisting of groundwater monitoring at SWMU 33. On July 10, 2018, EPA and the Department approved the document.

On Sept. 30, 2021, the Department issued a Missouri Hazardous Waste Management Facility Part I Permit to the KC Port Authority. The new permit provides jurisdiction for further investigation, remediation, and site-wide corrective action. SWMUs 1, 2, 3, 4, 5, 6, and 12, and AOCs 4 and 8 are on property owned by the Kansas City Port Authority and remain in the new permit.

On Sept. 30, 2021, the Department issued a final remedy decision for the remaining portions of the former Armco property. The Department issued a no-further-action decision for property owned by The Andersons Inc.; Hansen Property Development Inc.; Moly-Cop USA; and, Planned Industrial Expansion Authority. The Department also approved the final remedy for Ross Custom Properties which includes: completed interim measures at SWMUs 7 and 33, and AOCs 1 and 9; cap maintenance, engineering controls, and institutional controls at SWMU 3; monitored natural attenuation of groundwater at SWMUs 13, 17, and 33; and engineering and institutional controls in the form of an enforceable Environmental Covenant.

On July 28, 2022, the Department conducted the Fiscal Year 2022 annual inspection. During the inspection, the Department noted that trespassers are creating ruts in the landfill cap and surrounding areas and litter was present. The Kansas City Port Authority conducts security visits of the property three to four times per week.

General Geologic and Hydrologic Setting:

Surface soils are composed primarily of low-permeability, alluvial, silty clay, underlain by moderate-permeability alluvial silt and sand. Wastes deposited in permeable materials within an abandoned meander of the Blue River are at or below the water table. Groundwater monitoring at the RCRA landfill and the Old Blue River "W" landfill indicates that contaminants are not leaching from the landfills.

Depth to the water table ranges from 10 to 20 feet. Groundwater flow is toward the Blue and Missouri rivers. No known drinking water wells produce from the alluvial aquifer downgradient of the landfills.

Public Drinking Water Advisory:

No public water supplies are proximal to this site, and impacts are not expected.

Health Assessment:

The chemicals of concern at this site include lead, cadmium, and zinc. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects

associated with these contaminants. A previous exposure investigation conducted by the Missouri Department of Health and Senior Services documented no significant human exposure to site contaminants. Access to the site is restricted.

The only release of contaminants from the site appears to be via surface runoff into the Blue River. The Department and the U.S. Geological Survey conducted a study of stormwater runoff into the Blue River basin. This study revealed that, immediately following rainstorms in the lower Blue River basin, the level of zinc doubled between the upstream and downstream sampling points from ARMCO. This study also showed smaller increases in the lead concentration in the river at the downstream sampling site. Following heavy rainfall events, zinc and lead in the Blue River would be present in high concentrations in the suspended solids. As the suspended solids settle out, the lead and zinc in the deposited sediment potentially would be available to bio-accumulate in fish and other aquatic organisms.

Based on the contaminated surface water runoff into the Blue River, a potential public health threat exists through sediment and fish. The Blue River has a fish advisory for common carp and catfish of all sizes of one meal per month, based on polychlorinated biphenyls and chlordane detections; however, these advisories are not associated with this site. No site-related fish or sediment data are available at this time.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Baldwin Park

Site Name: Baldwin Park

Classification: Class 4

Date of Registry Placement: September 23, 1986

Site Address: Baldwin Park is located on High Street in the extreme northeast corner of the town of Aurora, Lawrence County, Missouri, NE 1/4, Sec. 7, T26N, RW, Aurora Quadrangle

Present Property Owner: City of Aurora

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), hexachlorophene, and lead

Quantity: Not determined

Site Description and Environmental Concern:

The Baldwin Park site is now the location of a municipal park. The area historically operated as a zinc ore strip mine. When mining operations ceased, the city of Aurora and surrounding communities used the pits as a dump for municipal trash. The U.S. Environmental Protection Agency (EPA) and the Department received reports that, in the mid-1960s, the Hoffman-Taff Corporation disposed of TCDD-contaminated wastes at the site. Later sampling substantiated these reports. In the 1970s, the city closed the dump and installed a cap over the site, and developed the property later into a park.

In July 1996, following a request by the city of Aurora to reduce the area listed on the registry, an environmental contractor conducted additional sampling to delineate the area of contamination. The contractor did not detect TCDD in the park's northern and northeastern areas. In response, the Missouri Department of Natural Resources (Department) reduced the area on the registry to include only 60 acres in the park's southern portion.

Remedial Actions:

In October 1983, EPA initiated investigations at Baldwin Park. Sample results indicated the presence of TCDD at concentrations ranging from 2.7 to 743 parts per billion (ppb), with the highest concentrations detected in discrete samples collected from exposed bags and drums. During this time period, EPA compared dioxin soil results solely to the EPA Preliminary Regional Goals (PRGs) for residential soil of 1 ppb and industrial soil of 5 - 20 ppb. In November 1984, EPA conducted additional sampling to determine the extent of contamination.

In winter 1987, EPA contractors excavated and removed approximately 250 cubic yards of soil that exceeded 20 ppb TCDD. The contractors transported the excavated soil to EPA's mobile incinerator in Verona, Missouri. The contractor covered and capped the excavated areas, as well as areas showing TCDD surface contamination between 1 and 20 ppb. The cap consists of 6 inches of sand; a brightly colored plastic liner that serves as an indicator; another 6 inches of sand; and 6 inches of topsoil. The topsoil was seeded and covered with a biodegradable erosion-control mat. The city of Aurora agreed to provide site maintenance and



to prevent excavation of the cover. To ensure that contaminated groundwater was not migrating off site, EPA monitored groundwater for one year.

In 2001, the Department conducted a Combined Preliminary Assessment/Site Investigation of the Lawrence County Mining site, which revealed elevated levels of lead in several residential yards in Aurora. As a result, EPA conducted a removal action in the area and excavated between 5,000 and 8,000 cubic yards of soil from residential yards.

In 2002, the Department approved the use of the Baldwin Park site as a repository for lead-contaminated soils excavated during the Lawrence County Removal Action. Contractors used the lead-contaminated soils in the construction of a berm, adjacent to the on-site gun club, to reduce noise levels and shot hazards inherent with the club's usage. Surface soil in the berm area contains lead at concentrations above EPA's residential action level of 400 parts per million. The contractors placed the lead-contaminated soil at the bottom of the berm structure, covered the lead-contaminated soil with 1 foot of clean fill, and vegetated the soil cap to eliminate erosion and exposure potential. The city of Aurora has responsibility to maintain the berm. The berm area is fenced to restrict access.

In summer 2004, Department staff met with the city of Aurora's Parks and Recreation Department to discuss plans for Baldwin Park. The city envisioned a set of walking trails and possibly fishing in some of the on-site subsidence ponds. In spring 2005, the Department performed an initial site assessment that characterized the park's mining-impacted portions. During the same period, the city of Aurora contracted with the University of Missouri to provide a final park plan. The park planning document included extensive development plans and detailed mapping of metals contamination. Department staff conducted additional sampling that confirmed fish obtained from the park ponds were safe for consumption.

In January 2006, contractors began site reclamation with the construction of perimeter fencing in an effort to prevent dumping and illegal vehicle use in the park. In October 2007, the city of Aurora received an EPA Brownfields Cleanup Grant to remediate soils impacted by former mining activity. In 2009, contractors removed vegetation and the top layer of contaminated soil and treated the remaining soil with high phosphate poultry litter to reduce metals toxicity. In September 2010, following Missouri Department of Health and Senior Services (DHSS) recommendations, contractors capped areas that contained residual contamination with 1 foot of clean soil and/or 4 inches of crushed aggregate. Contractors vegetated the capped areas with native plants.

In December 2010, the city submitted the final Cleanup Grant Project Report to EPA. The city planned to develop hiking trails and a fishing pond in the project treatment area. The city has not yet developed any hiking trails. In 2011, the city fenced the pond area. The city completed a Final Concept Plan dated April 25, 2022, for Baldwin Park. It includes adding a full-size baseball field, adding a softball field, playground, mountain bike and nature trails, play and picnic areas, and removing the shooting range. The city applied for a Land and Water Conservation Fund grant to help them fund this plan. Potentially, the city will begin construction on the new ballfields in 2023.

On April 20, 2022, the Department conducted the FY22 annual inspection, during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The Baldwin Park site is located on a broad, upland area characterized by very gentle slopes. The site straddles the drainage divide between the west-flowing Chat Creek and the north-flowing Elm Branch of Honey Creek.

Historically, this area has undergone some major land-use changes that altered the site's natural features. The area near the railroad tracks reportedly was swampy at one time. However, as settlers moved into the region, they drained the swampy area and converted it to an apple orchard. In 1886, miners discovered lead ore deposits, and subsequent surface and underground mining drastically altered the topography. The mining, which ceased in 1955, created open shafts, pits, millworks, and tailings piles. Reclamation has occurred at many of the mined areas. Water now fills some of the remaining open shafts and pits.

Exposed mineshafts reveal about 20 feet of residuum derived from the weathering of underlying bedrock.

The residuum is composed of reddish-brown, cherty, silty clay. Typically, this material develops a very blocky structure and exhibits high permeability. However, the residuum at the site seems to be atypical, as evidenced by the historically high water levels and swampy conditions.

The bedrock surface is uneven. The uppermost bedrock at the site is the Mississippian-age Burlington-Keokuk Limestone, except in the park's southern part, where a relatively thin layer of sandstone, shales, conglomerates, and limestone cover the Burlington-Keokuk in some locations. The Burlington-Keokuk Limestone, along with underlying Mississippian-age cherty limestones, make up the shallow aquifer in this area. Individual rural water supplies extensively use this aquifer, which is over 350 feet thick.

A confining layer separates the shallow aquifer from the deeper Cambrian- and Ordovician-age carbonates and sandstones that make up the deep aquifer. The deep aquifer is about 1,800 feet thick. Because of very high yields from this aquifer, it provides public water supplies for the area.

Both Chat Creek and Elm Branch are gaining streams near the site, but both lose water to the subsurface downgradient of the site. The lost water recharges the shallow aquifer, and some of it later discharges from springs. Water tracing studies have shown that water lost to the subsurface in the Honey Creek drainage emerges at Big Spring near the mouth of Williams Creek.

Public Drinking Water Advisory:

The combined Aurora-Verona public water system uses several deep wells in the area for drinking water. The closest of these wells is just under 1 mile from this site, but it is cased to over 300 feet deep. A small drive-in restaurant about 0.7 mile southeast of the site uses one public water well that is only cased to 165 feet deep and is likely open to both the shallow Springfield Plateau Aquifer and the deep Ozark Aquifer. Due to the relatively low permeability of soils in this area, site-related contamination is not likely.

Health Assessment:

The contaminants of concern at this site are TCDD, 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), hexachlorophene, and lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

DHSS recommends replacing warning signs around the area of contamination so they are visible to the public. Good hygiene practices, such as hand washing, can go a long way to reduce exposures. Any trails developed over areas with elevated lead levels should have adequate cover, using either mulch or gravel. As long as the cap remains intact, this site does not appear to present a significant public health risk at this time. If site conditions change to allow exposure to contaminated soil, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Chillicothe FMGP

Site Name: Chillicothe FMGP

Classification: Class 4

Date of Registry Placement: April 8, 2000

Site Address: Between Calhoun and Bridge Streets, Chillicothe, Livingston County, Mo., NW ¼, NW ¼, SE ¼, Sec. 36, T58N, R24W, Chillicothe Quadrangle

Present Property Owner: Empire District Gas Co.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Coal tar, which contains volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs)

Quantity: Not determined

Site Description:

The Chillicothe FMGP site is a former manufactured gas plant (FMGP) that released coal tar wastes resulting in volatile organic compound (VOC), semi-volatile organic compound (SVOC), and polycyclic aromatic hydrocarbon (PAH) contamination of soil and groundwater. The gas plant operated at this site from 1892 until 1939.

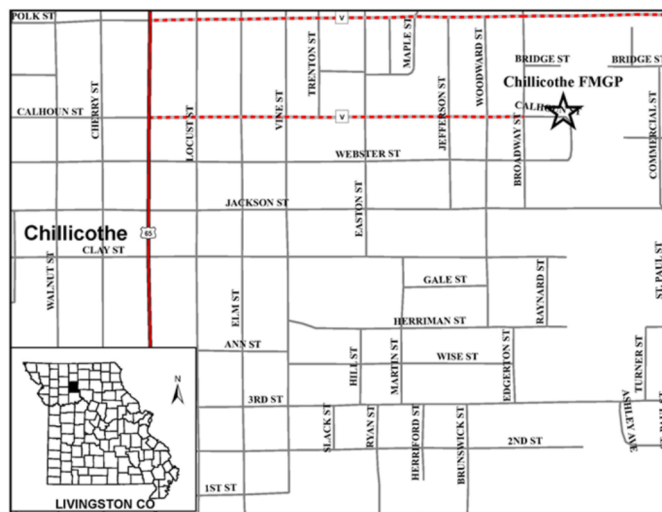
The site is 0.63 acre in size and is located in an industrial area adjacent to residential areas within the city of Chillicothe. The site is currently a service center for natural gas distribution in the Chillicothe area. It contains a metal warehouse used as an office and storage of parts and equipment. The remainder of the site is mostly a storage yard. The storage yard's surface is paved with cast-in-place concrete. A chain-link fence topped with barbed wire secures the site.

The Chillicothe FMGP first produced oil gas, which used coal or coke gas, and then changed to water gas, which used steam, hydrogen, and carbon monoxide gases, in 1913. After the plant stopped manufacturing gas, liquefied petroleum gas was stored at the site for distribution to the city. Estimated total production during the plant's 47 years of operation is 324million cubic feet of gas and 270,000 gallons of coal tar. Coal tar, a byproduct of the gas manufacturing process, is this site's primary waste of concern. Documentation suggests that remnant structures from past gas-manufacturing operations may be buried beneath the site.

Remedial Actions:

Around 1940, the property's owners at that time removed all gas-manufacturing equipment. In 1983, owners removed approximately 28,000 gallons of ignitable coal tar gas waste from the site and transported it to an approved hazardous waste incinerator.

Carcinogenic PAHs from coal tar were found in the surface soil and in one residential yard adjacent to the site. In November 1998, the Missouri Department of Natural Resources (Department) conducted Integrated Site Inspection/Removal Site Evaluation (SI/RSE) sampling that detected coal tar containing PAHs and VOCs at concentrations above regulatory limits in the subsurface soil. Specifically, benzene was present at a concentration above the Toxicity Characteristic Leaching Procedure regulatory limit of 0.5 part per million (ppm). One sample had a Toxicity Characteristic Leaching Procedure result of 7.8 ppm. On March 26, 1999, the Department completed the SI/RSE, concluding that the surface soil contamination was not a concern at



that time. The coal tar remaining in the on-site subsurface soil did not pose an exposure risk; however, it could become a threat if the site is ever excavated. The SI/RSE also determined that no known drinking water wells were located within a 1-mile radius of the site.

In 2007, as part of a service building expansion where additional building space was added onto the original building, Empire District Gas Co. (Empire) removed 168 tons of soil and 2,200 gallons of groundwater from the site, then encapsulated the area surrounding the building with a concrete cap. On May 9, 2017, Empire collected three drinking water samples: two samples from inside the building and one off-site sample from the Chillicothe public water system. They analyzed the samples for VOCs, SVOCs, and Resource Conservation and Recovery Act (RCRA) metals. None of the samples detected VOCs or SVOCs associated with the FMGP. One metal was detected, barium, at 21, 20, and 22 parts per billion (ppb), respectively. No maximum contaminant limit (MCL) exists for barium; however, these results are well below the secondary drinking water standard for barium of 2,000 ppb.

In 2018, Empire removed an old circular concrete pad that was part of the FMGP operations and excavated the soil/debris to approximately 3 feet below grade. Empire's environmental contractors collected soil verification samples, then backfilled the excavated pit, and poured a new concrete slab over the old pad's footprint. They analyzed soil samples for VOCs, SVOCs, and RCRA metals. All sample results were below laboratory detection limits or Missouri Risk-Based Correction Action (MRBCA) levels listed at the Lowest Default Target Levels. Therefore, based on these results, the remaining soil in this area does not appear to be impacted by FMGP compounds. The new concrete pad will prevent rainwater infiltration into the subsurface.

On April 20, 2022, the Department conducted the Fiscal Year 2022 annual inspection, and noted nothing of significance. Access to the site is restricted by fencing.

General Geologic and Hydrologic Setting:

The Chillicothe FMGP site is located in the Dissected Till Plains region of the Central Lowlands Physiographic Province. The area is blanketed by a layer of low-permeability glacial till, consisting of a poorly-sorted mixture of clay- to boulder-sized particles. A thin mantle of windblown loess covers the till. The thickness of unconsolidated deposits ranges from 0 to 180 feet in the area.

Pennsylvanian-aged bedrock, consisting of shale, limestone, and sandstone, underlies the unconsolidated material.

An east-west trending preglacial channel located just south of Chillicothe is the primary source of drinking water in the area. Minor amounts of poor-quality groundwater can be found in glaciofluvial sand and gravel lenses in the till. Yields from wells outside the preglacial channel are usually low, though preglacial channel wells can have substantial yields.

Water from the consolidated bedrock is mineralized, which increases with depth. In the early 20th century, the bedrock commonly was used as a source of groundwater, but all recent wells draw water from the unconsolidated sediments.

Public Drinking Water Advisory:

The city of Chillicothe uses several wells that draw from unconsolidated preglacial river channels. Four wells are located approximately 1.5 miles south-southwest of the site. The thickness of preglacial deposits is loosely constrained, but a transition between deposits less than 100 feet thick and those greater than 100 feet appears to trend roughly east-west between this site and the city's well field (situated in the thicker portion of the preglacial deposits). The possibility of groundwater flowing from the thinner deposits southward into the deeper and thicker deposits does exist, but no impacts to the city's wells have been identified. The specific subsurface flow of groundwater, again, is loosely constrained, and site-related contamination may not be migrating toward the city's wells. Although no impacts from this site are expected, any increases in contaminant concentrations identified through routine well monitoring would warrant additional scrutiny of potential pathways from the site to the city's well field.

Health Assessment:

Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Because the on-site contaminated area is capped, subsurface soil is not readily accessible. Risk associated with this site appears to be limited to potential vapor intrusion and migration of subsurface contamination into groundwater. If the cap does not remain intact, contaminants within subsurface soils could be taken in through ingestion or dermal contact with contaminated soil or through inhalation of dust and vapors.

Based on available information, this site represents a potential human health threat. Workers occupying the on-site building may be at risk from exposure to vapor intrusion (VI) into the building. Nearby residents may also be at risk from exposure to groundwater contamination. The level of risk for workers and residents remains uncertain due to lack of on-site VI and off-site groundwater sampling.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Farmland Industries

Site Name: Farmland Industries

Classification: Class 4

Date of Registry Placement: March 30, 1988

Site Address: 4th and Seneca Streets, St. Joseph, Buchanan County, MO

Present Property Owners: Burlington-Northern Santa Fe Railway Company (BNSF)

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Pesticides, polycyclic aromatic hydrocarbons (PAHs), heavy metals, and volatile organic compounds (VOCs)

Quantity: Not determined

Site Description and Environmental Concern:

The Farmland Industries site is a former pesticide formulation plant, with elevated concentrations of chlordane, heptachlor, Aldrin, dieldrin, and other pesticides in on-site soil and groundwater.

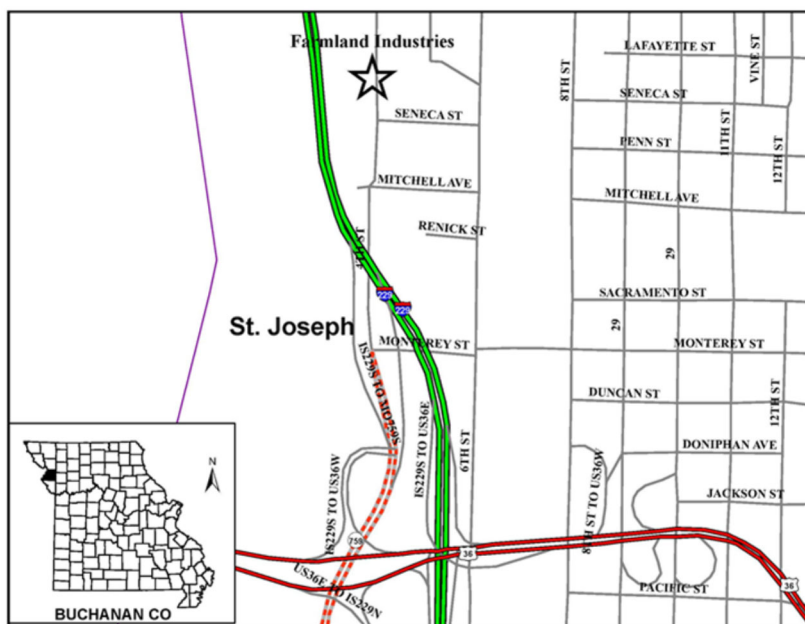
The site is approximately 2.6 acres in size and located on the eastern bank of the Missouri River in a moderately industrialized area of the flood plain. Numerous manufacturing and warehouse facilities are located adjacent to the site. BNSF owns the property and began leasing it to several companies for pesticide formulation in 1950. Pesticide formulation from 1950 until 1980 resulted in contamination of topsoil, subsurface soil, and groundwater. Farmland Industries was the last pesticide manufacturer to lease this property, from 1974 until the plant closed in 1980. Rinsate from liquid fertilizer solutions, as well as from floor and equipment washings, drained into a manhole on the property until 1977, when Farmland Industries plugged and removed it.

In late 1979 and early 1980, Farmland Industries removed the buildings and associated facilities. A 6-foot high, chain-link security fence encompasses the entire site. BNSF posted warning signs around the perimeter. In 1989, the site was clay capped and vegetated, and it remains a vacant lot.

In 2001, the Missouri Department of Health and Senior Services (DHSS) expressed concerns that Farmland Industries and EPA had not fully defined the extent of contamination, and that areas of contamination remained outside the fenced, capped property. In October 2008, as part of a site reassessment to address the DHSS' concerns, the Missouri Department of Natural Resources (Department) collected subsurface soil, surface soil, and groundwater samples, the results of which showed pesticide contamination on nearly all properties immediately surrounding the site at concentrations significantly above background and above EPA industrial screening levels. However, concentrations did not exceed EPA's industrial regional removal management or cleanup levels. Based on these exceedances, the Department requested DHSS to evaluate the site reassessment sampling results.

Remedial Actions:

On Nov. 2, 1989, EPA entered into an Administrative Order on Consent with Farmland Industries Inc.,



Missouri Pacific Railroad Company, and BNSF to implement the proposed capping plan.

Farmland Industries implemented a capping plan in November and December 1989. All quadrants of the site that contained a total pesticide concentration of 50 parts per million or greater were capped with 18 inches of clean clay soil. Farmland removed contaminated soil that exceeded the capping standard from immediately outside the existing fence and placed this soil under the cap. Farmland maintained the facility's fencing as the primary means of access control. Farmland also removed the above-grade structures that hindered cap placement. Then, in April 1990, Farmland prepared and seeded the site, and established a good vegetative cover on the clay cap.

Following the bankruptcy of Farmland Industries, Inc. in May 2002, the liquidating trustee, BNSF, and the Department reached a settlement agreement. BNSF has taken over site maintenance and reporting obligations pursuant to the settlement agreement, including submitting operational and maintenance reports that summarize all cap operation and maintenance activities during the preceding 12 months.

In 2017, EPA approved BNSF's request to reduce monthly site-cap monitoring to annual monitoring, and conducting an annual cap inspection each fall. BNSF also requested a new agreement for coordination of the oversight between BNSF and the Department, rather than BNSF and EPA. BNSF is drafting an Environmental Covenant (EC) for the Farmland site to ensure that the site's land use is not changed without further assessment and possibly remedial actions. The EC is not final yet.

On March 23, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which inspectors observed slight groundhog damage to the cap. BNSF plans to trap and remove the animal(s) and repair the cap.

General Geologic and Hydrologic Setting:

Overburden at this location is composed of fill material over thick alluvial deposits, which geologists estimate to be 60 to 100 feet thick. The alluvium consists of sand, silt, and clay, with the coarser-grained material predominant at depth. Clay-rich material is present beneath the site's eastern portion.

The uppermost aquifer at this location is the Missouri River alluvium. Depth to groundwater, as indicated by monitoring wells, is 10 to 25 feet. Off-site contaminant migration in groundwater most likely is toward the Missouri River; however, high-yield wells potentially may alter flow direction in the alluvial aquifer.

Because the bedrock here typically displays low permeability, the Department does not anticipate contaminants to affect groundwater in the bedrock.

Public Drinking Water Advisory:

The city of St. Joseph obtains groundwater from a well field in the Missouri River alluvium located several miles upstream from this site. No other public water sources exist in this area; therefore, no site-related public health impacts are expected from groundwater exposures.

Health Assessment:

The following are the major contaminants of concern: aldrin, chlordane, dichlorodiphenyltrichloroethane (DDT)/dichlorodiphenyldichloroethane (DDD)/dichlorodiphenyldichloroethylene (DDE), dieldrin, endrin, hexachlorobenzene, heptachlor, PAHs, and beryllium. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The Farmland Industries site is located in the Missouri River alluvium and is within 200 feet of the river. Because of the site's proximity to the Missouri River and the documented pesticide-contaminated soils and groundwater outside of the fenced and capped area, it is possible that the Missouri River is also affected. The chlorinated insecticides at this site are fat-soluble and known to accumulate in the food chain. If pesticides from the Farmland site are bioaccumulating in fish tissue, human exposure is possible through the consumption of contaminated fish. The Department of Health and Senior Services (DHSS) monitors for pesticides in fish throughout the Missouri River, but no recent site-related testing has been conducted.

On-site contamination does not appear to pose a significant public health risk at this time, as long as the clay cap, grass cover, and site fencing are maintained. Department sampling of the areas surrounding the Farmland site did find some low levels of pesticides and PAHs. In 2011, DHSS completed a Health Consultation for the Areas Surrounding the Farmland Industries Old Insecticide Plant Site. Considering that this is a vacant lot/industrial site where limited activity (working or trespassing) occurs, exposure to any substantial amount of contamination in surface soils is not expected. The current amount of exposure to chemicals in the areas surrounding the Farmland site is unlikely to harm people's health, as long as BNSF maintains the clay cap, grass cover, and site fencing.

Any land use changes would require a site reassessment to determine exposure potential, including soil, water, and air sampling. Long-term stewardship mechanisms should also be employed to ensure that the site's land use is not changed to allow greater human contact to site contaminants (such as allowing residential use) without further assessment and possibly remedial actions.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Jones Truck Lines

Site Name: Jones Truck Lines

Classification: Class 4

Date of Registry Placement: January 1, 1984

Site Address: 5601 Hall St., St. Louis, St. Louis City, MO

Present Property Owner: Sibic Realty LLC

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,3,7,8-Tetrachlorodibenzodioxin (TCDD)

Quantity: Not determined



Site Description and Environmental Concern:

The Jones Truck Line site is the location of a former truck terminal that sprayed oil mixed with chemical manufacturing waste containing TCDD on the gravel parking area for dust suppression around 1971. As a result, TCDD is present in the soil at depth.

The privately-owned facility is a 6-acre parcel located in a commercial/industrial area along the Mississippi River north of the St. Louis city center. The property has a brick building along the south end, a connected and roofed truck-parking bay, and a smaller, separate building in the northwest corner. Except for building footprints, the entire property is paved, fenced, and has a lockable gate.

Following grading and development of the parcel, Jones Truck Lines Inc. operated a truck terminal at the site beginning sometime after 1965. Sun Carriers Inc. acquired Jones Truck Lines Inc. in 1980. Sun Carriers Inc. subsequently moved trucking operations off site. Another lessee is using the parcel as a trucking transportation hub.

In 1983, the U.S. Environmental Protection Agency (EPA) conducted sampling at the site as part of a regional assessment of areas potentially contaminated by TCDD. EPA detected levels of TCDD in soil above the health-based benchmark of one part per billion (ppb). TCDD concentrations exceeded 20 ppb in some areas of the site, mandating a cleanup action.

TCDD remains in subsurface soils beneath an asphalt cap at concentrations above health-based cleanup levels. Deterioration or disturbance of the asphalt cap could result in direct exposure to dioxin-contaminated material.

Remedial Actions:

In the early 1980s, EPA collected samples from a sampling grid established across the parcel. EPA documented concentrations of TCDD above 20 ppb in surface and shallow subsurface soil/gravel/fill material in several of the grid cells located primarily on the parcel's southern half. EPA found many other parcels to contain dioxin concentrations between 1 and 20 ppb.

The Jones Truck Lines site is one of 27 eastern Missouri dioxin sites that are subject to a Consent Decree entered in Federal District Court on Dec. 31, 1990. On July 21, 1995, EPA completed an Engineering

Evaluation/Cost Analysis. The purpose of the analysis was to select the remedy and cleanup criteria for 27 eastern Missouri TCDD-contaminated sites. The cleanup criterion established in the Engineering Evaluation/Cost Analysis for industrial and commercial properties, such as Jones Truck Lines, was 20 ppb.

Since TCDD concentrations documented at Jones Truck Lines exceeded 20 ppb, EPA conducted a cleanup action. In 1995, EPA oversaw the excavation of 3,635 tons of soil from sampling grid cells where TCDD exceeded 20 ppb. EPA transported the soil to Times Beach for incineration. Clean fill material was imported to the site, and EPA capped the entire surface with a 6-inch layer of asphalt.

A 2012 Registry site inspection noted areas throughout the parking lot that had cracks in the pavement. On May 1, 2013, Pioneer Paving addressed these cracks as part of maintaining the cap. On May 29, 2013, Missouri Department of Natural Resources (Department) staff visited the site and observed the areas that had been patched/repaved. In July 2015, Sibic Realty LLC bought the property. Sibic Realty LLC had a Phase I Environmental Site Assessment conducted and noted damage to the pavement around the truck scale in the site's northwest area and along the fence on the northwest perimeter. On June 25, 2015, Pioneer Paving and Sealing Company addressed these two areas. On July 14, 2015, Department staff inspected and verified that the property owner had repaved and properly sealed the pavement.

On May 3, 2022, the Department completed the Fiscal Year 2022 Registry annual inspection, during which inspectors noted minor cracking in the asphalt and concrete parking lot. No substantial changes have been made to the site.

General Geologic and Hydrologic Setting:

The site is located on the western edge of the Mississippi River flood plain. Much development has occurred in this area, with many alterations to the natural setting. The thickness of the fill material is unknown; however, due to the site's age, the majority of ground surface settling has probably already occurred. The asphalt cover restricts surface water infiltration.

The alluvial material beneath the site is composed of clay- to sand-sized particles. The alluvium is expected to be less than 45 feet thick. The direction of groundwater movement is toward the river, where it is eventually discharged. Due to the area's industrialized nature, some contamination of the alluvial waters is probable, but a specific source would be very difficult to identify. It may take several years for any contaminants present in the shallow groundwater system to discharge to the river. Bedrock under the site is Mississippian-age limestone. At this location, the Mississippian limestones are not favorable for the development of drinking water wells, since high total dissolved solids render the water unusable for most purposes.

Public Drinking Water Advisory:

The city of St. Louis draws water from the Missouri and Mississippi rivers from locations upstream of this site. Illinois American Water – East St. Louis draws from the Mississippi River approximately 4 river-miles downstream. No impacts are expected.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The TCDD-contaminated material beneath the asphalt cap poses no direct exposure concern at the site, and migration through surface water runoff or groundwater infiltration is unlikely as long as the cap remains intact. If the cap deteriorates or is disturbed, potential exposure routes of concern would include ingestion of contaminated soil, inhalation of contaminated dust particles, and dermal contact with contaminated soil or dust. Cap removal or deterioration could result in erosion and migration of the contaminated material off site through surface water runoff.

Based on available information, this site does not appear to pose a significant public health risk at this time. However, if site conditions change such that exposure to contaminated soil occurs, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Joplin Oil Ponds

Site Name: Joplin Oil Ponds

Classification: Class 4

Date of Registry Placement: June 14, 1984

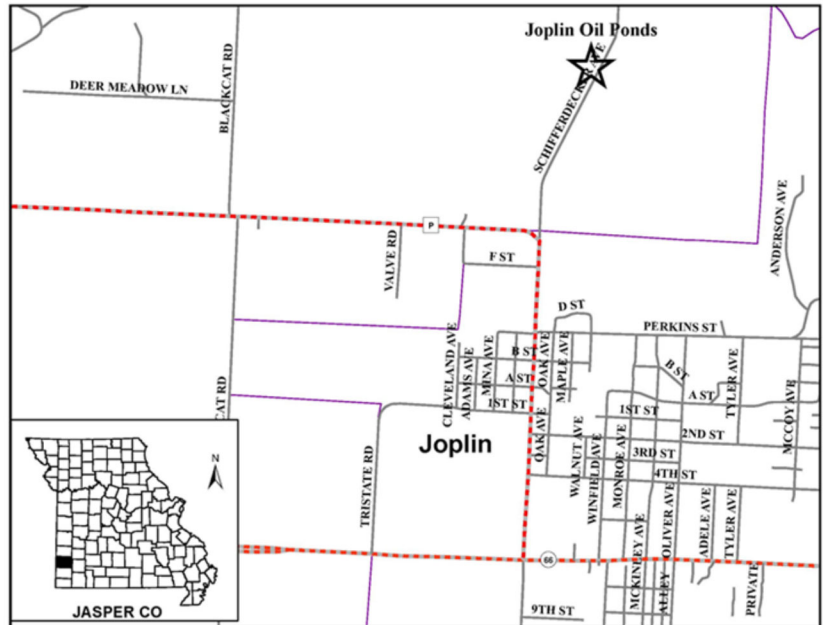
Site Address: Joplin, Jasper County, Missouri, SW 1/4, NW 1/4, Sec. 33, T28N, R33W, Joplin West Quadrangle

Present Property Owners: City of Joplin

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Lead

Quantity: Unknown quantity of residual lead contamination remains on-site



Site Description and Environmental Concern:

The Joplin Oil Ponds site consists of two former city lagoons where septic tank haulers dumped waste containing barium, chromium, lead, dichloroethane, trichloroethane, p-chloro-m-cresol, pentachlorophenol, and semi-volatile organic compounds for more than 30 years. Residual lead contamination remains in surface soil following closure of the lagoons, and treatment and disposal of contaminated sludge.

The city of Joplin owns the former lagoons and surrounding 34 acres. The area of concern consists of shallow soil depressions with standing pools of water where the lagoons were located. Vegetation is encroaching the area. The city has dumped debris from the 2011 Joplin tornado and other fill material in the surrounding area. The area north of the former lagoons also appears to be a dumping ground for debris. The lagoons are in close proximity to mined areas that are part of the Tri-State Mining District.

Various entities dumped hazardous waste at the site from 1955 until 1986, when the city discontinued using the lagoons. The lagoons remain inactive. With Missouri Department of Natural Resources (Department) approval, the city removed the hazardous waste sludge over several years; however, lead levels remained above residential standards.

In 1990, the Department conducted the most recent environmental sampling at the site. Sampling results showed that lead levels remained above residential standards in soil. With lead levels persisting in soil, the potential for groundwater contamination in the mined areas and solution cavities of the shallow bedrock aquifer remains. Monitoring of Joplin's public drinking water sources in the area have not shown elevated lead levels.

Remedial Actions:

In November 1988, the Department approved a remedial action plan for the city of Joplin to treat the pond water and discharge it to the city's wastewater treatment plant. The city mixed the sludge with fly ash to stabilize and partly dry it. The city disposed of the water at the Peoria Disposal Services Inc. facility in Peoria, Illinois. Removal of contaminated soil from the lagoons' bottoms and sides continued into February 1989. Several rounds of sampling determined that lead was the only parameter still exceeding the 1990 Missouri Department of Health and Senior Services' (DHSS) residential applicable standards of 238 parts per million (ppm), and the Cleanup Action Levels for Missouri (CALM) industrial soil target concentration of 660 (ppm)

in the surface soil. Even after the city removed more material from the ponds between 1989 and 1990, lead levels still exceeded residential standards. Follow-up sampling conducted in 1990 showed soil-lead levels at 780, 850, and 870 ppm from composite samples taken at two bank areas in the lower pond, and from one composite sample taken at the upper pond's bottom. The current U.S. Environmental Protection Agency (EPA) regional screening action limit for lead in industrial soil is 800 ppm.

Sampling of residual water in the ponds and public drinking water in the vicinity showed that the site is not causing water pollution problems. The city of Joplin owns the non-residential property. The surrounding area is industrial, with high concentrations of mine tailing wastes deposited there from past lead mining, milling, and smelting operations from the Oronogo-Duenweg mining belt. The surrounding lead levels are higher than the any-use residential standard.

On May 3, 2022, the Department conducted a site inspection for fiscal year 2022. The inspection report noted nothing of significance.

General Geologic and Hydrologic Setting:

Residual soils that have developed from Mississippian-age limestone are present at the site. The residuum contains a high percentage of stone in a clay matrix and exhibits high permeability. Residuum thickness near the lagoons is estimated to be 10 feet; however, the area has been reworked, and some of the soil may have been removed.

Below the surface soil is a cherty, Mississippian-age limestone, which extends 80 to 120 feet below the surface. This limestone has undergone extensive weathering, producing subsurface cavities that provide avenues for water movement. Mining ores are present at a depth of about 80 feet. Room-and-pillar mining methods were once used to remove the ore. Consequently, numerous mine shafts are located on and around the property, and extensively-mined areas lie beneath the site. Large voids created by past mining are now filled with water, and large chat (mining waste) piles are present along the eastern and southern property lines. Potential for catastrophic collapse exists at the site, due to both the nature of the underlying bedrock and possible subsidence from the mining activity.

Two aquifers exist in the area: a shallow aquifer consisting of Mississippian-age limestone at the zone of mineralization; and, a deep aquifer consisting of Cambro-Ordovician sandstone, dolomite, and chert, located well below the ore-bearing strata. Surface and shallow groundwater movement near the lagoons is generally to the east toward Leadville Hollow, and to the north toward Turkey Creek, a gaining stream. Due to the permeable nature of the soil and bedrock material, the site is likely adversely affecting the shallow groundwater.

Public Drinking Water Advisory:

Missouri American Water – Joplin and Jasper Co. PWSD #2 both use deep wells to draw water from the Ozark aquifer. The closest well to this site is approximately 1.2 miles to the north and belongs to Jasper Co. PWSD #2. Missouri American Water – Joplin has three wells that are located approximately 2-3 miles south, southwest, and southeast of the site. Groundwater in this area generally flows to the north and east, but karst conditions and mine-related shafts and cavities make unpredictable pathways for rapid, shallow groundwater movement. Local groundwater withdrawals create aquifer drawdown within the region, which adds uncertainty to the issue of potential contaminant mobility. Migration of contaminants from the site does not appear to pose a significant threat to local public water sources; however, any detection of contaminants in water produced by these wells would warrant additional scrutiny. Treatment by both public water systems, verified by regular post-treatment testing, effectively removes lead and other potential contaminants from the groundwater, thus protecting customers from possible exposure.

Health Assessment:

The chemical of concern at this site is lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The city removed contaminated water and much of the sludge and soil during a 1988 cleanup. Several samples taken after this cleanup found lead levels in the lagoon bottom and sides above DHSS'

recommended residential level of 238 ppm. The city has installed an orange barrier fence to deter illegal dumping where the former lagoons are located.

Possible exposure routes for this site include ingestion, dermal contact, and inhalation of lead contaminated on-site soils. Any use of the property could result in exposure, but based upon available information, this site remains a low potential public health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Lebanon Phosphorus Spill

Site Name: Lebanon Phosphorus Spill

Classification: Class 4

Date of Registry Placement: July 1, 1985

Site Address: Two miles northeast of I-44 and W Highway, east on gravel road alongside tracks for 200 feet past Huben railroad marker, Laclede County, SE 1/4, SW 1/4, SW 1/4, Sec. 12, T33N, R17W, Phillipsburg Quadrangle

Present Property Owner: Burlington Northern Railroad/San Francisco Railway Company

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Red and yellow phosphorus

Quantity: 5,000 gallons in buried railcar

Site Description and Environmental Concern:

The Lebanon Phosphorus Spill site resulted from the Aug. 13, 1972, derailment of a Frisco freight train, now Burlington Northern Santa Fe (BNSF), about 2 miles northeast of Phillipsburg, Missouri. The wreck caused spillage of portions of two tank cars of "red and yellow" phosphorus, another car described variously as soda ash or 12-12-12 fertilizer, one car of "mineral wool," and one car of wooden ties. The wreck caused a fire, fueled by the phosphorus, which ignites on contact with air. One of the 10,000-gallon phosphorus cars was completely burned, while the other car was only half burned, leaving about 5,000 gallons of liquid; the percentage of phosphorus unknown.

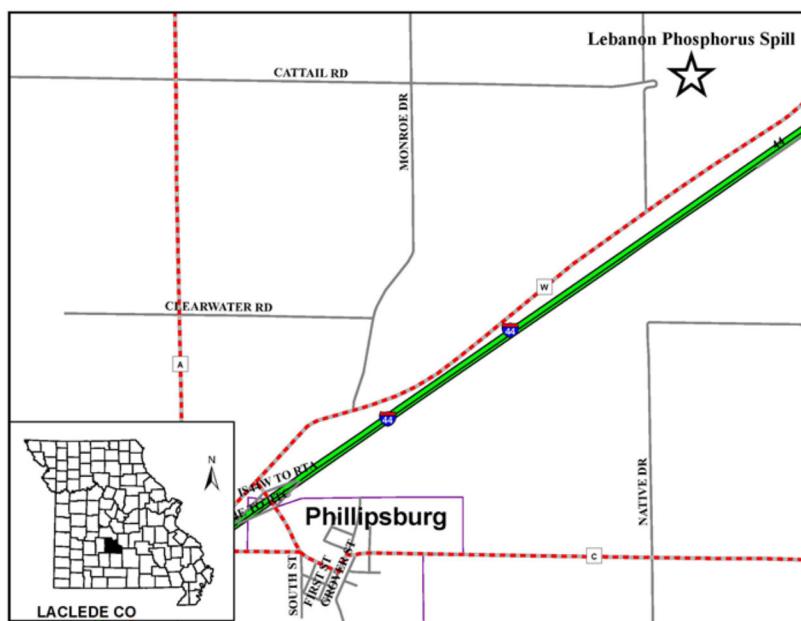
BNSF buried both of the tank cars on site and capped the site. The current cap remains in good condition. The site is located in an upland setting just north of the railroad tracks and east of a county road. No residences are in the immediate vicinity, and land use is agricultural.

Remedial Actions:

In August 1972, BNSF buried the two wrecked tank cars on property adjoining the railroad property in order to extinguish the phosphorus fire. BNSF capped the burial site with an asphalt pad. BNSF placed a stone marker, containing warnings not to drill or dig, on top of the pad. Over the years, the asphalt cap began to deteriorate and crumble. In October 1988, BSNF installed a new 4-inch-thick concrete cover. The cover measures about 60 by 90 feet, and BNSF graded the cap slightly to prevent ponding of water. It consists of a sand layer covered by 5-ounce polypropylene, then covered by an 18-mil mirafi-coated fabric. To prevent damage to the cover, BNSF placed sections of steel pipe around the pad's perimeter to prevent vehicles from driving over it.

The Department and the Missouri Department of Health and Senior Services (DHSS) conducted well sampling in 1994, 1996, and 1999, and found no evidence of contamination above the drinking water standards in any of the tested wells.

To determine if contaminant migration had occurred, BNSF collected subsurface soil samples advanced to a depth of 20 feet below ground surface and adjacent to the buried railcars in 2000 (six borings) and 2007



(eight borings). Phosphorus sample results ranged from 67.8 to 6,260 parts per million (ppm), and from less than 11.5 to 583 ppm, respectively. Background concentrations of phosphorus range from 400 to 1,000 ppm, according to information obtained from Missouri State University. At the time of the soil investigation, BNSF did not encounter groundwater. BNSF repaired and resealed the concrete cap as a preventive measure to ensure its continued effectiveness. BNSF established new fencing around the cap's perimeter of sufficient height to discourage vandals.

In September 2013, BNSF conducted site groundwater monitoring activities. Due to the absence of groundwater in both monitoring wells, BNSF installed only two of the four proposed monitoring wells, MW-01 and MW-02. BNSF did not observe water in these two wells. The total depths for MW-01 and MW-02 were 29.10 feet below ground surface and 25.47 feet below ground surface, respectively.

On Sept. 25, 2013, as part of routine track maintenance, a BNSF maintenance-of-way crew excavated soil beneath a mainline track, which is adjacent to the Lebanon Phosphorus site. BNSF stockpiled the excavated soil approximately 50 feet northwest of the concrete pad. The maintenance-of-way crew observed intermittent small wisps of smoke coming from the stockpiled soil.

On Sept. 26, 2013, Compliance One, the environmental contractor responsible for the concrete pad's annual sealing, observed smoke coming from a single location in the soil stockpile and reported this to the BNSF Environmental Remediation Manager. The stockpiled soil was located near trees; therefore, BNSF requested that Compliance One move a portion of the soil to an area on site that was not near vegetation. The contractor also reported seeing small, intermittent wisps of smoke while moving the soil. The contractor assumed the material releasing the smoke was yellow or red phosphorus reacting with oxygen in the air. The contractor moved a portion of the stockpile and placed a construction fence around the stockpile to limit access by unauthorized personnel. The contractor placed plastic sheeting over the soil and silt fencing around the stockpile to limit soil migration via storm water runoff. The contractor estimated the volume of phosphorus in the soil to be a very small percentage of the soil stockpile, based on visual observations made by the maintenance-of-way crew and by Compliance One staff.

On Nov. 21, 2013, BNSF submitted to the Department a work plan for managing the soil stockpile. The contractor submitted a finalized Health and Safety Plan on Feb. 3, 2014. The work to address the contaminated stockpile soil started in April 2014, and the contractor completed the final grading and seeding of the storm water berm in September 2014. BNSF placed signs along the right-of-way in this area to notify maintenance-of-way crews not to excavate the soil without notifying the BNSF Environmental Remediation Manager. In addition, BNSF delineated the location on its internal Geographic Information System.

In April 2015, the consultant made a site visit and discovered vehicle ruts in the revegetated area. BNSF regraded and reseeded the damaged vegetated area. The consultant had concrete barricades installed to prevent future trespass by vehicular traffic. Semiannual site visits to monitor site conditions, mow vegetation, perform maintenance to the concrete pad, and measure water level will continue. If adequate groundwater is present in a well, the contractor will collect and analyze groundwater samples for total phosphorus.

On April 5, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which the inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located in an upland setting. On-site soils are composed of stony and sandy clay residuum. Bedrock is composed of sandstone, chert, and dolomite of the Roubidoux Formation. The downstream area is characterized by numerous karst features, such as sinkholes and losing stream segments.

The residual soils in which the tank cars are buried are expected to be highly permeable at depth. Leakage from the tank cars could flow through the gravel and enter surface water at Jacob's Lake downgradient of the site. The potential also exists for downward vertical migration of contaminants directly into groundwater supplies. Any surface discharges ultimately would enter groundwater supplies through the losing drainage downstream of Jacob's Lake. Regional groundwater supplies could be affected if substantial wastes were to be released in a single event.

Public Drinking Water Advisory:

One public water well, belonging to Laclede Co. PWSD #1, is located approximately 0.17 mile south of the site. This well is cased to 600 feet deep, and no site-related impacts are expected. No other public water wells are close to this site.

Health Assessment:

The major contaminants of concern found at the site are nitrogen (nitrate), white phosphorus, and phosphate. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Three forms of phosphorus were spilled at the site, including yellow, red, and a constituent of soda ash containing phosphates. Because the phosphorus disposed at this site is buried, capped, and marked, the only possible route of exposure would be through contaminated groundwater supplies. In 2011, DHSS analyzed two private wells for total phosphorus. Test results showed total phosphorus levels of 16 parts per billion (ppb) and 17 ppb, both of which exceed EPA's threshold for white phosphorus in drinking water of 0.7 ppb. In 2013, DHSS sampled specifically for white phosphorus, which is the most toxic of the three forms of phosphorus. One location permitted DHSS to re-sample, and the analysis for white phosphorus showed that it was not detected.

Based on available information, this site poses no current health threat. However, if this site were altered, direct contact or inhalation of vapors from the oxidation of the phosphorus could occur. Because of the highly explosive nature of phosphorus when it comes in contact with air, the hazards associated with removal outweigh the possible health effects of allowing the material to remain buried.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Lee Chemical

Site Name: Lee Chemical

Classification: Class 4

Date of Registry Placement: January 1, 1984

Site Address: South of old Highway 210 and north of the railroad tracks, about 0.7 miles east of Highway 291 in Clay County, Missouri, NE 1/4, SW 1/4, Sec. 28, T51N, R31W, Liberty Quadrangle

Present Property Owners: City of Liberty

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Trichloroethene (TCE) and other volatile organic compounds (VOCs)

Quantity: Not determined

Site Description and Environmental Concern:

The Lee Chemical site is a former packaging, distribution, and disposal facility for various commercial and industrial chemicals, including chlorinated solvents. As a result of poor storage practices and abandoned drums left on-site, TCE and other volatile organic compounds (VOC) are present in on-site soils and groundwater, as well as groundwater serving the off-site municipal raw water supply wells. The city of Liberty (city) owns the site and is leading the remedial process with Missouri Department of Natural Resources (Department) oversight.

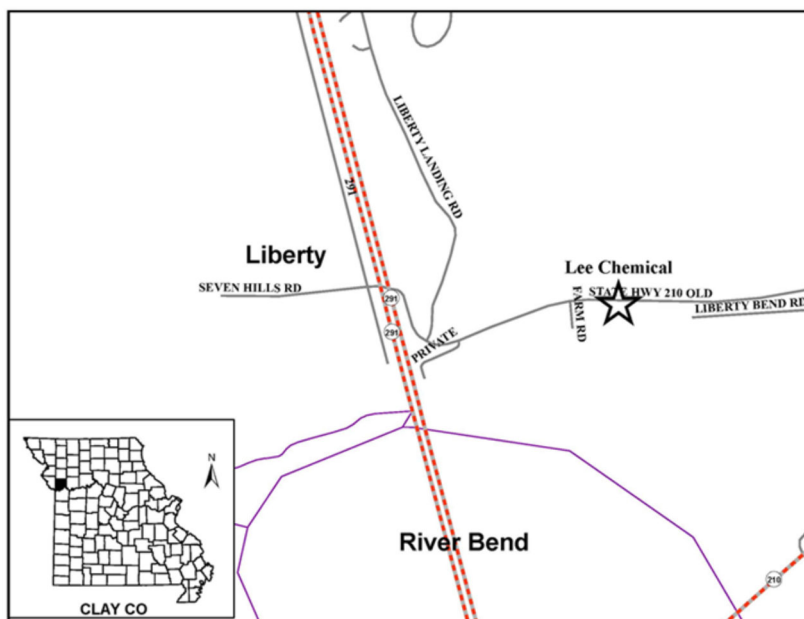
The site is a 2.5-acre narrow strip of land situated between Old State Highway 210 and the Burlington Northern Railroad in a rural industrial area. A single rural residence is located to the northeast, followed by the Capitol Federal Sports Complex of Liberty. The site consists of a grass-covered area enclosed with chain-link fencing and one gated entrance.

From approximately 1920 through 1962, the site served as the city's water treatment plant. Beginning in 1965, the Lee Chemical Company leased the property from the city and operated out of the old water plant building. In 1975, the city evicted Lee Chemical, who abandoned the site, leaving behind numerous drums of hazardous waste.

In July 1977, the city removed approximately 300 55-gallon drums containing various hazardous wastes. In 1979, the Department detected TCE in the city's municipal raw water supply wells. In 1982, the Department inspected the site and found additional deteriorating drums and apparent soil contamination. Also in 1982, the U.S. Environmental Protection Agency (EPA) and the Department sampled the municipal wells and detected TCE as high as 440 parts per billion (ppb). In 1983, the city removed the old water plant building. EPA and the Department sampled the municipal wells again and found lower TCE concentrations from the same wells, but still as high as 320 ppb. EPA also collected soil samples in the former treatment plant area and detected TCE as high as 4500 ppb.

Remedial Actions:

The city completed remedial actions under Department oversight over the years, which were effective in



reducing TCE levels in the groundwater and municipal water supply. EPA conducted additional cleanup activities on-site.

On March 21, 1991, EPA signed the Record of Decision. The remedy featured four elements: continued extraction of contaminated groundwater; installation of an on-site in situ aqueous soil washing system; discharge of the extracted groundwater under a state permit; and, continued monitoring and progress reports.

In March 1992, the Department and the city entered into an Administrative Order on Consent for the Remedial Design/Remedial Action. In January 1994, the city began operating the remedial action, and on April 26, 1994, the Department and EPA determined that the system was operating as designed.

In January 2012, the city submitted an optimization evaluation report to the Department. Based on the report, the city had conducted additional groundwater, surface water, and soil investigations. On Feb. 23, 2016, the city submitted a "Groundwater and Surface Water Investigation Results Summary Memorandum" to the Department.

The city operated the remedial action system until Sept.30, 2015. The city shut it down to allow a comprehensive soil and groundwater re-evaluation during a focused feasibility study (FFS). On Dec. 1, 2017, the city submitted the "Lee Chemical Superfund Site Focused Feasibility Study." Groundwater monitoring during the FFS demonstrated that the site was impacting only one city municipal well. Public well #2 showed low levels of cis-1,2-DCE at concentrations of 1.0 – 2.5 ppb in 2019.

On July 29, 2019, the Department completed, and EPA concurred on, the fifth five-year review report. The agencies determined that the remedial action was operating as designed and was effectively protecting human health and the environment in the short term. The agencies continue to work with the city and its consultant to revise the site's FFS report to determine the best path forward, which could include retaining, revising, or choosing a new remedy.

On June 16, 2022, the EPA approved the Quality Assurance Project Plan for the FFS.

On July 28, 2022, the Department conducted a site inspection, during which inspectors noted nothing of significance.

The city of Liberty's contractor submitted the final soil FFS for review on Aug. 2, 2022.

General Geologic and Hydrologic Setting:

The site is located on an alluvial plain of the Missouri River near the northern valley wall. The site is underlain by about 60 to 90 feet of alluvium, with the upper 15 to 35 feet of alluvium predominately fine-grained material. The deeper alluvium comprises mostly coarse-grained sands and gravels.

The water table is within 10 to 20 feet of the surface, and the flow direction is to the east-southeast. All of the city's municipal wells are hydraulically downgradient of the site; therefore, the downgradient flow velocity is increased by the influence of the municipal wells.

Bedrock structure, type, and erosional configuration may influence the transportation of contaminants that have migrated downward to the base of the alluvium. Geophysical and borehole data indicate that the bedrock surface, while quite uneven, slopes generally to the south and east. The uppermost bedrock unit below the site is predominantly shale; however, it may also include thin sandstones and/or limestones.

Public Drinking Water Advisory:

The city operates 11 wells that draw from Missouri River alluvium less than 1 mile east and south of the site. Remediation activities have significantly reduced site-related contamination as proven by a reduction of TCE and other VOCs. Continued tracking of annual monitoring trends is recommended to help ensure site-related contamination does not impact the wells.

Health Assessment:

The major contaminants of concern at the site are: 1,1-dichloroethene (1,1-DCE); cis -1,2-dichloroethene (cis-1,2-DCE); 1,1,1-trichloroethane (1,1,1-TCA or TCA); and, TCE. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Ingestion of contaminated groundwater from the municipal well field was the main route of exposure. In the past, significant exposure occurred for individuals using the public water supply. Interviews with area residents failed to uncover any patterns of adverse health effects consistent with exposure to site-related contaminants. Remedial actions at the site have significantly reduced VOC contaminant levels in the groundwater and are continuing.

As part of the site's third five-year review and at the Department's request, the Missouri Department of Health and Senior Services reviewed site information and provided a risk assessment. Two contaminants, vinyl chloride and acetonitrile, neither of which had been reported during the previous two five-year reviews, were incorporated into the risk assessment. Although the remedy is functioning as intended and many wells show either non-detects or substantial reductions in the levels of contaminants of concern over the review period, vinyl chloride, a product of the biological reduction of TCE, was found to exceed EPA's drinking water maximum contaminant level in two site wells. Acetonitrile, reported in site wells since 2006, has only modest toxicity. However, it can be metabolized to produce hydrogen cyanide, which can cause toxic effects. Along with TCE, acetonitrile contributed substantially to the non-carcinogenic risk at the site. Reports of relatively high detection levels of vinyl chloride, acetonitrile, and TCE would seem to suggest the need for further/ continued monitoring of site contaminants.

Based on available information, a potential health risk exists, due to the presence of VOCs in on-site soils, as well as in on-site and off-site groundwater.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Minker Property

Site Name: Minker Property

Classification: Class 4

Date of Registry Placement: June 14, 1984

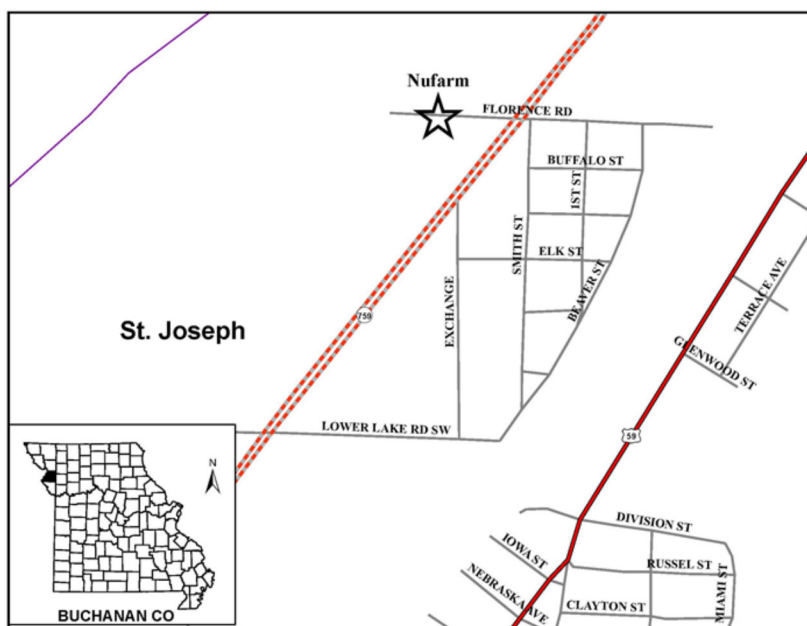
Site Address: 4037 West Rock Creek Road, Hillsboro, Jefferson County, MO

Present Property Owners:
Carl and Betty Fisk Trust

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,3,7,8- Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined



Site Description and Environmental Concern:

The Minker Property site is a residential property where soil that contained 2,3,7,8- Tetrachlorodibenzo-p-dioxin (TCDD or dioxin) was imported and used as fill material. In 1971, a private contractor sprayed oil that contained TCDD in three horse arenas in eastern Missouri as a dust suppressant. In 1974, workers excavated TCDD-contaminated soil from the Bubbling Springs horse arena and used the soil as fill material in a residential area approximately 1.5 miles southwest of the arena. Based on the owner's name at that time, the U.S. Environmental Protection Agency (EPA) designated one of the affected residential properties as the Minker Property site. EPA conducted a removal action at each of the affected properties to excavate the TCDD-contaminated soil and replace it with clean fill. It was not possible to excavate all the contamination at the Minker property, and some TCDD-contaminated soil remains at depth.

On Sept. 24, 2003, the Minker Property was sold to a private citizen and has not been developed or otherwise changed since that time. The site is located in a residential area. The land surface of the site is vegetated with no structures. A fence surrounds the site with a locked gate to prevent public access.

Remedial Actions:

In 1988, EPA completed the cleanup at the Minker Property site. EPA excavated TCDD- contaminated soil to a 4-foot depth before workers struck bedrock and halted excavation. EPA's post-excavation sampling of this area showed that levels of TCDD as high as 266 parts per billion remained. EPA filled in and capped the excavated area with clean top soil, and installed permanent survey markers to delineate the area where contamination existed at depth. EPA constructed erosion-control walls in the area where the contamination remains. The excavated material temporarily was stored on site in five storage buildings before EPA transported it to a thermal treatment facility at Times Beach, Missouri, for incineration.

The Minker Property site is one of 27 eastern Missouri dioxin sites that are subject to a consent decree entered in federal court Dec. 31, 1990. In accordance with the decree, EPA constructed a thermal treatment unit at Times Beach to destroy the TCDD-contaminated materials removed from this site. This included 26,420 tons of bagged materials that EPA transported from the Minker Property to the Times Beach Thermal Treatment Facility between December 1996 and February 1997. EPA removed the temporary on-site storage buildings as part of the cleanup, and site restorations are complete. The EPA initiated a Five-Year Review for the Minker Property in March 2022. A completion date has not been set.

On May 17, 2022, the Department completed the Fiscal Year 2022 Registry annual inspection and noted the vegetation is thick and overgrown where the former Minker house and erosion control walls are located.

General Geologic and Hydrologic Setting:

The site is located in an upland area, with steep slopes adjacent to streams. Surface drainage from the site enters Romaine Creek, which loses water to the subsurface.

The surficial materials beneath the site consist of several feet of wind-deposited, silty clay, or loess, over stony clay that was derived from the weathering of bedrock. The bedrock is deeply-weathered limestone.

Water-tracing studies indicate that water lost to the subsurface in the upper reaches of Romaine Creek reemerges at two springs in the lower portion of the watershed. The water first reemerges at Mastis Spring, located about 1 mile north of the site. A portion of the water discharged from Mastis Spring is in turn, lost to the subsurface, emerging at Bubbling Spring, about 1 mile farther downstream.

Public Drinking Water Advisory:

The nearest public water well to this site lies over one mile southwest and serves a mobile home park. The Minker Property site is not expected to impact this well.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

Because residual TCDD remains at this site, the Missouri Department of Health and Senior Services recommends that monitoring continues to prevent potential erosion and disturbance, which could lead to exposure. Maintaining the cap will eliminate potential direct exposure to contaminated soils. Currently, no health effects are expected, because exposure is not occurring. Adverse health effects could result if any changes to site conditions were to allow exposure to contaminated soils.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Modine Manufacturing

Site Name: Modine Manufacturing

Classification: Class 4

Date of Registry Placement: January 8, 1996

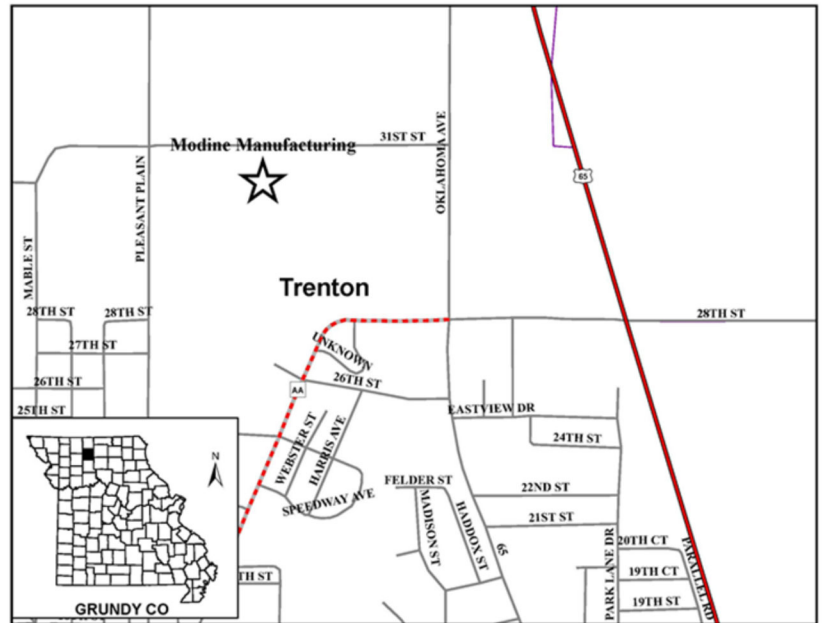
Site Address: 822 Industrial Drive,
Trenton, Grundy County, MO

Present Property Owner: Modine
Manufacturing

Lead Agency: Missouri Department of
Natural Resources (Department)

Waste Type: Heavy metals and chromium

Quantity: Not determined. Approximately
36,000 gallons of metal hydroxide sludge
disposed in unlined pit



Site Description and Environmental Concern:

The Modine Manufacturing Company (Modine) site is a vehicle radiator manufacturer who disposed of approximately 36,000 gallons of metal hydroxide sludge in a constructed, unlined pit measuring about 75 by 16 feet and 10 feet deep, from 1971-1976. This led to soil contamination with a variety of metals. The former pit area is now an open grassy field. In 1976, Modine built an addition to the manufacturing facility, which included a wastewater treatment facility.

On Sept. 9, 1995, Modine's contractor collected several soil borings downgradient of the sludge pit area. The sample results indicated that no significant migration of hazardous waste from the sludge pit area had occurred. Surface water and groundwater are at risk of contamination if metals migrate from the capped pit.

Remedial Actions:

In October 1998, Modine capped the area with clay and topsoil. The company seeded the area, and vegetative cover is now well established and well maintained. No additional remedial action has occurred.

On April 20, 2022, the Department completed the Fiscal Year 2022 Registry annual inspection, during which inspectors noted nothing of significance. The site appeared well kept and marked at each corner boundary by white flags.

General Geologic and Hydrologic Settings:

This site is located on the Dissected Till Plains of northern Missouri. The area is blanketed by a layer of low-permeability till, consisting of a poorly-sorted mixture of clay to boulder-sized particles. A thin mantle of loess, or wind-deposited silt, covers the till.

Bedrock composed of shale, limestone, clay, and sandstone is present at a depth of 50 to 100 feet below the surface. Gravel layers within the till provide the primary source of groundwater for this area. Yields from wells in the till generally are low, though very high yields may be obtained from pre-glacial stream deposits. These types of stream deposits exist east of the city of Trenton at a distance of more than 2 miles from the site.

Water from the consolidated bedrock is highly mineralized, and the mineral content increases with depth. Wells drilled to a moderate depth into bedrock may yield a limited amount of water that is of marginal quality.

Public Drinking Water Advisory:

The city of Trenton obtains water from the Thompson River, which is unaffected by this site. No impacts to public water sources are anticipated from this site.

Health Assessment:

Contaminants of concern at this site include cadmium, chromium, copper, lead, and zinc. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Metals present at the site are mobile and may migrate off site in groundwater or surface water if the cap material erodes or is damaged. Consequently, both surface water and groundwater would be at risk of contamination. A May 1998 investigation by the Missouri Department of Health and Senior Services found no private wells near the site.

No significant off-site migration of hazardous wastes has occurred. Based on available information, this site does not pose a health risk as long as it is well maintained and the cap remains intact.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Neosho Digester and Trenches

Site Name: Neosho Digester and Trenches

Classification: Class 4

Date of Registry Placement: January 9, 1984

Site Address: Neosho, Newton County, Missouri, part of NE 1/4, NE 1/4, Sec. 16, T24N, R32W, Neosho West Quadrangle

Present Property Owner: City of Neosho

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and 2,4,5-trichlorophenol (TCP)

Quantity: Not determined

Site Description and Environmental Concern:

The Neosho Digester and Trenches site includes an abandoned concrete sewage digester and the adjacent trench area. The site received contaminated rinse water and wastewater from the Northeastern Pharmaceutical and Chemical Company (NEPACCO) from 1971-1987. In 1981, the U.S. Environmental Protection Agency (EPA) sampled the site and documented elevated 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and 2,4,5-trichlorophenol (TCP) concentrations in soil.

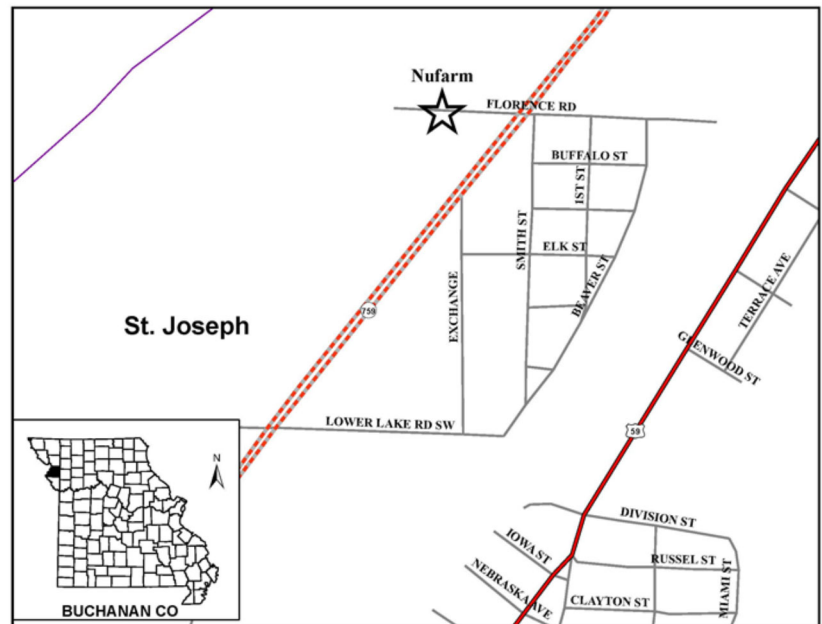
The city of Neosho continues to conduct wastewater treatment operations on this property directly west of the site. The city owns the site property and provides a chain-link fence around a maintained grassy hill where the 0.89-acre site is located.

In 1971, NEPACCO, located in Verona, Missouri, put 225,000 gallons of contaminated rinse water and wastewater into the digester for the Neosho wastewater school to use in treatability studies. In 1978, the wastewater school dumped scrap material into the digester, causing it to overflow on the north and east sides. The wastewater school also excavated a trench next to the digester to bury the contaminated wastes. The city decommissioned the contaminated digester and provided a cap to prevent water infiltration and exposure.

The potential for groundwater contamination remains due to soil permeability. Surface water contamination from erosion and stormwater runoff may also potentially occur.

Remedial Actions:

In June 1981, EPA collected samples from Buffalo Creek, both upstream and downstream, and from four local private wells. None of the samples detected either TCDD or TCP. As part of a 1984 EPA consent order, the city of Neosho capped the trench area and installed four vertical test wells around the site's perimeter to be used for soil sampling and possibly for groundwater monitoring. The city conducted subsurface investigations to determine engineering properties of subsurface soils. In June 1988, EPA drilled at an angle underneath the digester to check for TCDD contamination in the soil. Soil samples contained no TCDD contamination, demonstrating that no leaks or cracks are present at the digester's base. Soil located in the trench to the east of the digester contains TCDD at a concentration of 0.5 parts per billion (ppb). The EPA



consent order requires the city to maintain the clay cap and to restrict site access. No additional cleanup or groundwater monitoring was completed.

On March 16, 2022, the Department conducted a physical site inspection and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located in an upland setting with surface drainage to the west. The topography and geology are typical of the Springfield Plateau.

Soils range from silty clay to silty and clayey gravel. Bedrock is Mississippian-age, cherty limestone. Permeability in this limestone is high along solution-enlarged openings. Springs and losing-stream segments are located in the upland drainages. However, no sinkholes are in the site's vicinity, and no record exists of catastrophic sinkhole collapse in the immediate area.

Water lost to the subsurface recharges the shallow aquifer, which consists of cherty limestone. This aquifer is a water supply for individual homes in rural areas. It is separated from the deeper aquifer by a confining layer, the Chattanooga Shale. The deeper aquifer is the source for some public water supplies in the area, as well as some of the deeper private wells.

Rainfall in the area near the digester percolates through the underlying gravelly soil and migrates through fracture openings into bedrock. Some of the water discharges at nearby springs, and some is pumped from wells that are open to the shallow aquifer. Any water-soluble or liquid contaminants present outside the digester would follow the same pathway. The deeper aquifer has not been affected; however, connections between the upper and lower aquifer may exist due to the presence of wells that are open to both aquifers.

Public Drinking Water Advisory:

Although area geological conditions may allow rapid shallow groundwater movement, the closest public water well to this site is nearly 2 miles away. No impacts to public water sources are expected.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

TCDD is not leaking from the digester. Based on available information, a threat to public health does not exist at this time, as long as the site is mowed routinely, fenced and gated, and visually inspected for erosion and cap deterioration.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Overnite Transportation

Site Name: Overnite Transportation

Classification: Class 4

Date of Registry Placement: January 22, 1992

Site Address: 7455 Hall Street, St. Louis,
St. Louis City, MO

Present Property Owner: UPS Freight Inc.

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description and Environmental Concern:

The Overnite Transportation site is a location where Pacific International Express sprayed waste oil mixed with chemical manufacturing waste containing 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin) on a gravel-covered lot for dust suppression in the early 1970s. As a result, TCDD is present in the soil underneath an asphalt cap at EPA approved industrial levels at that time of 5-20 ppb.. Pacific International Express owned the property in the late 1960s and early 1970s. Overnite Transportation Company, now UPS Freight Inc., acquired the property in 1981 and used it as a trucking transportation hub.

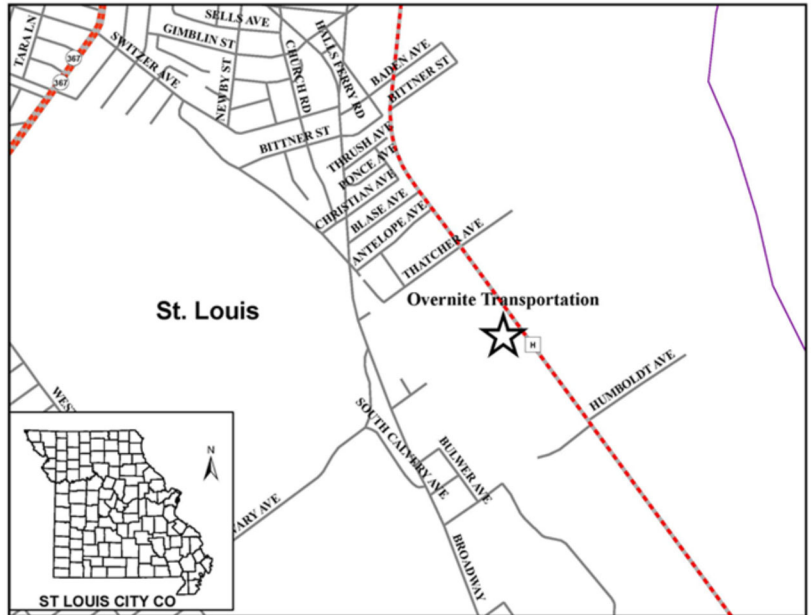
The 10-acre site is located in an industrial area of St. Louis. Buildings cover approximately 57,000 square feet of the 10-acre parcel, and the remaining portions are paved. Midwest Shingle Recycling Company most recently operated on the property, where they stored, ground, and recycled waste tear-off asphalt shingles. Midwest Shingle Recycling moved to a different location, but left behind equipment and materials (shingles/waste). This is a Missouri Department of Natural Resources (Department) Waste Management Program (WMP) active enforcement case. The property is fenced and gated.

Deterioration or disturbance of the asphalt cap could result in direct exposure to TCDD-contaminated material.

Remedial Actions:

In 1990, the U.S. Environmental Protection Agency (EPA) collected soil samples from within a 72-cell sampling grid established across the parcel. TCDD was detected in six of the grid cells at concentrations between 1 and 5 parts per billion (ppb). These six grid cells were located in an area approximately 50 feet southwest of the main building (still extant). Five additional grid cells, located farther to the southeast, contained TCDD at between 1 and 2 ppb. TCDD concentrations were below 1 ppb in the remaining 61 grid cells. The cleanup criterion for TCDD at industrial and commercial properties, such as the Overnite Transportation site, was 20 ppb.

The Overnite Transportation site is one of 27 eastern Missouri dioxin sites that are subject to a Consent Decree entered in Federal District Court Dec. 31, 1990. In accordance with the Consent Decree, EPA constructed a thermal treatment unit at Times Beach, Missouri, to treat the TCDD-contaminated materials excavated from these sites. On July 21, 1995, EPA completed an Engineering Evaluation/Cost Analysis. The



purpose of the analysis was to select the remedy and cleanup criteria for the 27 dioxin-contaminated sites. Since the cleanup criterion for TCDD at industrial and commercial properties was 20 ppb, and no TCDD concentrations above 20 ppb were documented at this site, no excavation was conducted. In order to prevent future contact with the contaminated material at the site, a 6-inch asphalt cap was placed across the property.

On May 3, 2022, the Department completed the Fiscal Year 2022 Registry annual inspection, during which the inspector noted they could not assess the condition of the cap for much of the site, due to the presence of asphalt shingles piles. The shingle piles are a solid waste issue. The property owner and the shingle business owner, Midwest Shingle Recycling, who leased the space, are involved in legal negotiations to address the remaining shingles. Midwest Shingle Recycling no longer has any equipment on site and no longer operates on site. Tear-off asphalt shingles have remained on site since the 2018 annual inspection.

General Geologic and Hydrologic Settings:

The site is located 0.5 mile west of the Mississippi River on the western edge of the flood plain. The site is protected from the river by an Army Corps of Engineers floodwall. The topography is flat, and the landscape is dominated by industrial development. The entire lot surrounding the buildings is paved with asphalt and concrete.

Surficial materials along Hall Street are a mixture of fill, alluvium, and alluvial-type soils. The fill is composed mainly of construction debris deposited in low-lying areas during the 1930s to raise the land elevation. Specific locations of fill are unknown. The Mississippi River valley alluvium near the site is expected to be 45 feet thick or less and consists of silt with some sand. Coarser sands are expected to predominate at depth. Permeability values across the flood plain can change significantly from layer to layer, especially in the near-surface units. While detailed investigation would be needed to evaluate the specific subsurface conditions at the site, soil permeability is expected to be moderate to high.

Bedrock beneath the site is Mississippian-age Ste. Genevieve Limestone, which is a massively-bedded, sandy, clastic limestone, with some layers of chert and some sandstone lenses occurring locally. The Ste. Genevieve Limestone, and a sequence of similar Mississippian-age carbonates beneath it, are not favorable for drinking water wells. High concentrations of naturally-occurring, dissolved solids in the area render the bedrock aquifers unsuitable for most purposes.

The water table is less than 20 feet from the ground surface at normal river levels. Due to its extremely low water solubility, TCDD is not expected to migrate readily into the groundwater.

Public Drinking Water Advisory:

The city of St. Louis obtains water from the Missouri and Mississippi rivers upstream from this site. No site-related impacts to public water sources are expected.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The TCDD-contaminated material beneath the asphalt cap poses no direct-exposure concern at the site, and migration through surface water runoff or groundwater infiltration is unlikely, due to the extremely low water solubility of TCDD. If the cap deteriorates or is disturbed, potential exposure routes of concern would include ingestion of the contaminated soil, inhalation of contaminated dust particles, and dermal contact with the contaminated soil or dust. Removal or deterioration of the cap could result in exposure to the contaminated material on site, as well as potential erosion and migration of contaminated material off site through surface water runoff. No health risk exists at this site, as long as the asphalt cap is maintained properly.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Pigeon Hill Landfill

Site Name: Pigeon Hill Landfill

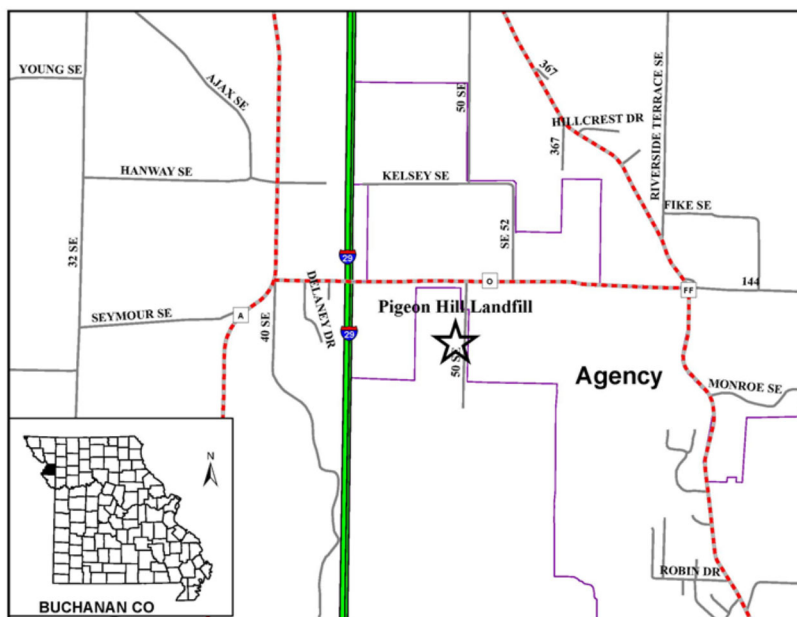
Classification: Class 4

Date of Registry Placement: June 14, 1984

Site Address: Ten miles south of St. Joseph, bordering the Northeast corner of the Pigeon Hill Wildlife Area, St. Joseph, Buchanan County, SE 1/4 of the SW 1/4 of Sec. 12, T56N, R35W, St. Joseph South Quadrangle

Present Property Owner: Buchanan County (Trustee)

Lead Agency: Missouri Department of Natural Resources (Department)



Waste Type: Heavy metals, pesticides, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs)

Quantity: The landfill contains an estimated 100 tons of industrial wastes.

Site Description and Environmental Concern:

The Pigeon Hill Landfill site consists of a 36-acre, closed landfill. Partially-wooded ridges and valleys are present to the north and south. The site is directly north of and adjacent to the Missouri Department of Conservation Pigeon Hill Conservation Area. The active 160-acre St. Joseph sanitary landfill is located across the road to the southwest. The Pigeon Hill Landfill received a mixture of residential, commercial, and industrial waste between 1969 and 1978, when operations ceased. The Missouri Department of Natural Resources (Department) estimates that various entities may have deposited more than 100 tons of industrial wastes in the landfill during that period. In 1994, Buchanan County took ownership of the property following the failure of the previous owner, Frank Norris, to pay taxes.

Prior to Buchanan County's landfill closure activities in 1999, leachate from seeps along the landfill's southern portion discharged into a drainage leading into Pigeon Creek, which flows through the conservation area. The Department's environmental sampling detected a variety of contaminants in the leachate and in surface water near a leachate seep. Contaminants include: the heavy metals arsenic, barium, cadmium, chromium, nickel, and zinc; the volatile organic compounds (VOCs) acetone, cyclohexane, xylene, and carbon disulfide; pesticides and herbicides including parathion, chlordane, heptachlor, 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and hexachlorobenzene; and the semi-volatile organic compounds (SVOCs) pyrene, fluoranthene, bis(2-ethylhexyl)phthalate, and 2,4-dichlorophenol. The Department detected several of these contaminants in landfill soil. People could be exposed to on-site contaminants if the landfill cover is not properly maintained.

Leachate from the landfill also has the potential to affect groundwater.

Remedial Actions:

In August 1995, Buchanan County constructed a runoff-collection pond in the landfill's northeastern portion to capture leachate surfacing in that area. The county later addressed this area through regrading and capping in 1999, and leachate is no longer an issue. As part of the landfill's 1999 closure, the county conducted grading, shaping, and smoothing actions, and constructed a storm water/leachate-collection pond at the

landfill's southern end. The county pumps leachate water regularly from the collection pond and takes it to St. Joseph's wastewater treatment plant. A final soil cap and vegetative cover is in place, and fencing surrounds the entire site.

The Department determined that Buchanan County met all closure and enforcement requirements for the Pigeon Hill Landfill. The city of St. Joseph must continue to follow its management plan to repair the landfill cover when needed and continue to prevent leachate from leaving the landfill property.

On March 22, 2022, the Department conducted the Fiscal Year 2022 annual inspection, during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The on-site soils initially consisted of about 20 feet of loess underlain by variable thicknesses of glacial till. However, site disturbance altered the soil's natural conditions. Unconsolidated material directly beneath the landfill is expected to consist of about 0 to 10 feet of silty clay, underlain by sandy clay at depths of 10 to 15 feet below the surface. The sandy clay reportedly contains interbedded sands, ranging from 1 to 6 feet in thickness at depths of 25 to 70 feet. These interbedded sand lenses contain appreciable amounts of shallow groundwater and could be affected by site contamination.

The uppermost bedrock beneath the site is the Amazonia Limestone. Because the till and underlying bedrock typically display very low permeability, there is little likelihood that contaminants will migrate into deep groundwater supplies. Furthermore, deep groundwater supplies in this area typically are marginal in quantity and quality.

Shallow, large-diameter wells may have been dug on or near the facility and could still exist on site. If abandoned wells were not plugged properly, groundwater supplies could be affected by contaminant migration down boreholes.

Public Drinking Water Advisory:

The city of St. Joseph obtains water from alluvial wells along the Missouri River that are unaffected by this site. No impacts to public water sources are expected.

Health Assessment:

Numerous chemicals, including some carcinogens, are present in leachate from the Pigeon Hill landfill. The major contaminants of concern at the site are: arsenic, barium, bis(2-ethylhexyl)phthalate, cadmium, chromium, fluoranthene, manganese, nickel, pyrene, 2,4-dichlorophenol, and zinc. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The county covered the landfill with clean soil and has an established vegetative cover. Failure to maintain the landfill cap or to capture leachate and prevent it from discharging from the site may result in human exposure to contaminants in surface water and soil.

Groundwater in the aquifer beneath the site may be at risk of leachate contamination. Some older private drinking water wells may exist in the area. However, a public water system now serves the area and is used by most nearby residents.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Prier Brass Manufacturing Company

Site Name: Prier Brass Manufacturing Company

Classification: Class 4

Date of Registry Placement: July 14, 1986

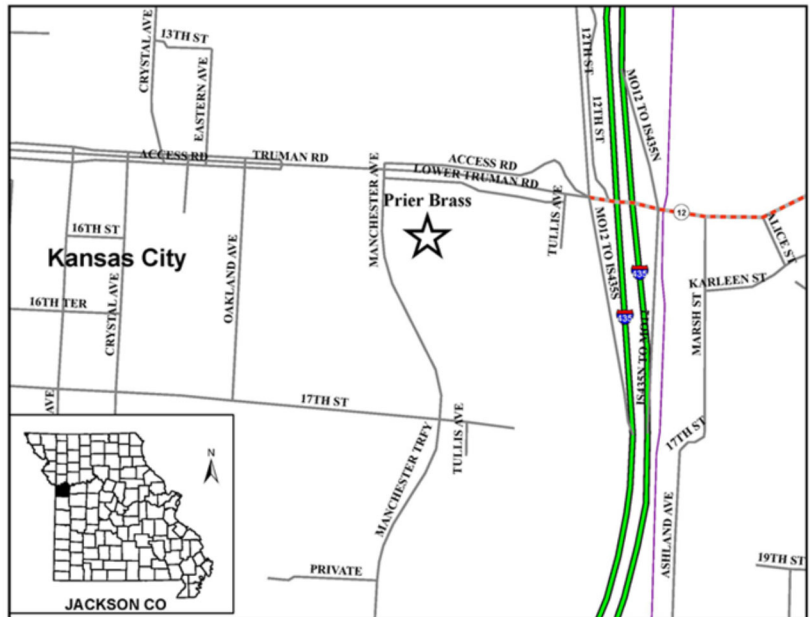
Site Address: 7801 Truman Road, Kansas City, Jackson County, MO

Present Property Owner: WCA– KC Transfer, LLC

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Lead and cadmium

Quantity: Not determined



Site Description and Environmental Concern:

The Prier Brass Manufacturing Company (Prier Brass) site is a former brass manufacturing facility whose operation produced foundry waste containing high concentrations of lead and cadmium. Prier Brass operated from 1907 until 1985, when the company went bankrupt and ceased all manufacturing activities. Because of past manufacturing practices, lead and cadmium are present in on-site soil.

The privately owned site property is approximately 9.5 acres in size and is located in an industrial area of Kansas City, Missouri. The Blue River lies 300 feet west of the site. The U.S. Army Corps of Engineers completed re-channelization of the Big Blue River in 2005, moving the channel away from the facility. The nearest residence to the site is approximately 0.4 mile to the east. The site currently has two large buildings on the property. Shelter Distribution Inc., a building materials wholesaler and manufacturer, is located on the property's northeast corner. WCA Kansas City Transfer and Recycling (WCA) is located on the southwest portion of the property. WCA is a full-service, non-hazardous solid waste company providing waste collection, recycling, and disposal services to commercial, industrial, and residential customers. The property's northeast and southwest portions are gravel parking lots. The property owner restricts site access by a wall or a fence provided with a lockable gate.

Investigations at the site began in 1984, when the Missouri Department of Natural Resources (Department) responded to a fish kill in the Blue River. The investigation revealed that Prier Brass was discharging a blueish-colored liquid into the river and disposing of foundry waste and baghouse dust onto the north bank of the Blue River. The Department ordered Prier Brass to cease discharging wastewater to the river and to either pretreat the wastewater before release, or discharge it to the city sewers with permission from the Kansas City Water Pollution Control District. The Department asked Prier Brass to test its foundry waste and baghouse dust to determine if they should be deemed toxic hazardous wastes. Results from a composite sample of foundry waste and baghouse dust showed elevated levels of both lead and cadmium.

Remedial Actions:

In 1989, the Department conducted a Preliminary Assessment and Site Inspection and discovered elevated concentrations of arsenic, cadmium, chromium, and lead in various environmental media.

Extraction Procedure toxicity tests revealed that the foundry sand contained unacceptable levels of leachable lead. The baghouse dust contained unacceptable levels of both leachable lead and cadmium. The

Department referred the site to the U.S. Environmental Protection Agency (EPA) to conduct a removal assessment. EPA sampled and assessed the site to determine the extent of contamination. In February 1996, EPA completed a removal action, during which it removed, stabilized, and shipped contaminated material off site for disposal. EPA designated 1,000 parts per million (ppm) as the lead action level. Contractors filled in the excavated areas with clean fill. EPA does not plan to conduct additional cleanup actions. Contaminated foundry wastes remain under a portion of the building. EPA and the federal Agency for Toxic Substances and Disease Registry determined that leaving the waste underneath the building is protective of human health.

In 1995, EPA performed a removal action to remove more than 50,000 cubic yards of contaminated material to prevent its release into the Big Blue River adjacent to the site. Contamination remains under some of the on-site buildings, and the potential for groundwater contamination at the site exists.

On June 16, 1997, EPA and the new property owner, CST, L.L.P., entered into a Prospective Purchaser Agreement for a portion of the Registry site that CST purchased. In 1997, CST installed a 4-inch layer of gravel, adding more gravel over the years, as the original gravel became compacted. In 1997, the Department approved a Change of Use request made by CST to develop the site as an operational base for a construction company that included a material recovery facility. The request adequately addressed human health and environmental concerns related to the proposed Change of Use. As part of this request, CST installed a truck weigh station, which required excavation into the previously buried baghouse wastes. CST also constructed a small building for use as an office in the area, adjacent to the Big Blue River channel.

In 2004, CST sold its interest in the building to Manchester Transfer, LLC. In May 2005, the Department issued the owner in succession, Manchester Transfer, LLC, a solid waste permit (# 609504) to operate a transfer station. In 2006, Manchester Transfer removed a large smoke stack, along with the building's east side section and rear dock.

In 2012, Manchester Transfer, LLC, sold the property to C Rae Properties, LLC. EPA's Covenant Not to Sue (formally known as a Prospective Purchaser Agreement) transferred to C Rae Properties, LLC. In 2014, WCA-KC Transfer, LLC purchased the property. EPA transferred the existing agreement and Covenant Not to Sue to WCA-KC Transfer LLC, but added language that required the new owner to convert to the Uniform Environmental Covenants Act process during its ownership (i.e., before property transfer).

As of April 2015, the owner demolished both the original building and the building that stood over the area of interest. The owner left the existing floor slabs of both buildings intact. All of the structural foundations remained as well. In 2017, the owner also removed the outside walls of the original building.

In May 2017, WCA submitted a permit modification request to the Department to construct an addition at the Kansas City Transfer building's north and west ends. In January 2018, the Department approved the request.

On May 18, 2022, the Department conducted the Fiscal Year 2022 annual site inspection, during which the inspectors reported that the owner had built a new covered area for recycling on top of the capped area.

General Geologic and Hydrologic Setting:

The site is located next to the Big Blue River. On-site soils are a mixture of fill material, underlain by alluvial deposits of clay, silt, sand, and gravel. Bedrock at depth is composed principally of interbedded shale and limestone. Typically, the bedrock is characterized by low permeability.

The potential exists for off-site surface soil contamination, due to the proximity of waste materials to the Big Blue River. Floodwaters and surface runoff may wash these contaminants into the river. However, the potential for off-site migration via surface water decreased with completion of a removal action.

Depth to the water table is expected to fluctuate with the river stage, but is probably between 10 and 25 feet below the flood plain surface. Contaminants in solution potentially could affect the shallow groundwater supplies of the Big Blue River alluvium. Although the alluvial sediments under the area of waste disposal have not been fully characterized, the effects of contamination on shallow groundwater likely are localized.

Public Drinking Water Advisory:

No public water sources are located in the site's immediate vicinity, and no site-related impacts to public water sources are expected.

Health Assessment:

Lead and cadmium are the chemicals of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Based on actions taken at the site, exposure to contaminated material is unlikely; therefore, the potential health risk is low, as long as the area remains graveled and paved.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

R & O Processors - Hwy 60

Site Name: R & O Processors—Hwy 60

Classification: Class 4

Date of Registry Placement: October 10, 1991

Site Address: About three miles west of Granby on Highway 60 in Newton County, Mo., NE 1/4, NW 1/4, Sec. 10, T25N, R31W, Granby Quadrangle

Present Property Owners: Robert W. Moffet

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Heavy metals and cyanide

Quantity: Not determined

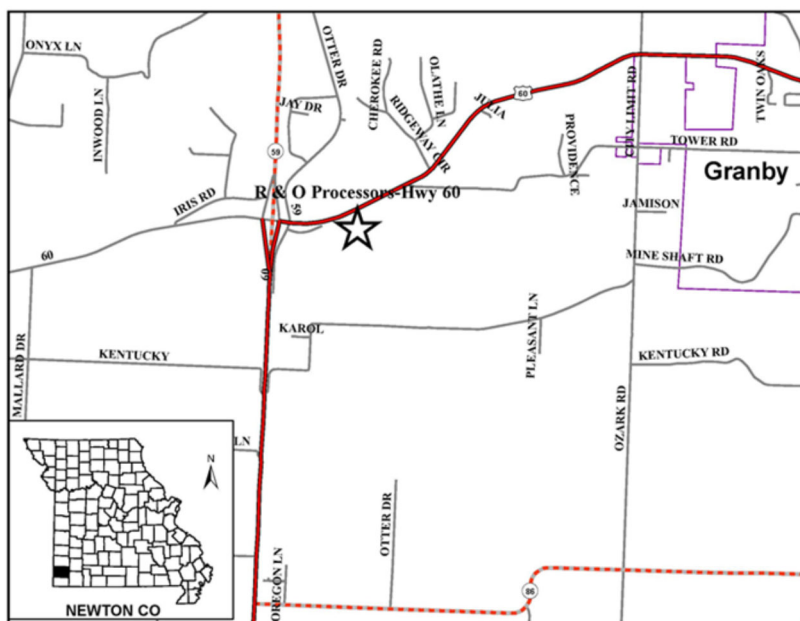
Site Description and Environmental Concern:

The R&O Processors (R&O) Highway 60 site is a former electroplating facility located 3 miles west of Granby on Highway 60 in Newton County. From 1981 to 1990, R&O performed metal-finishing processes using various metals, including zinc, brass, copper, chromium, and nickel plating. Because of mishandling of hazardous wastes and deterioration of the building's foundation and the exterior sludge-storage vats, residual heavy metals and cyanide are present in surface soils and building media.

The site is located in a rural, light industrial area. About 50 residences are located within 1 mile of the site, and 25 residences are within 0.5 mile. Residences border the site to the east, west, and north. Unused pastureland is located to the south. Shoal Creek is located 1.75 miles north of the site. The site covers two parcels of property; the former metal plating facility is located on one parcel, and the current property owner and former R&O operator resides on the other parcel, approximately 50 yards to the west.

In 1990, the owners filed both business and personal bankruptcy, and abandoned the former plating facility. In 1992, the U.S. Environmental Protection Agency (EPA) completed removal activities at the site. EPA removed and disposed of contaminated soils, plating wastes, and sludge. EPA sandblasted and pressure washed the former processing building and the sludge storage vats located outside the building's south end. A 1992 Public Health Assessment stated that residual contaminant levels within the building media didn't present a significant threat to public health or welfare, provided that appropriate institutional controls are in place to ensure that future property use remains consistent with past industrial/commercial use.

In April 2004, the Missouri Department of Natural Resources (Department) sampled surface soil from the former processing building's east side. Sample results showed metals, pentachlorophenol (PCP), and toluene at low concentrations. In May 2008, a tornado destroyed the building. The owner placed broken building blocks in the pits behind the facility. Well water samples collected from both the R&O facility well and the owner's (Robert Moffet) residential well, which is located on the same property, have consistently had detections of metals of concern (cadmium, chromium, copper, zinc, lead, nickel, and arsenic) below the maximum contaminant level for water. In the R&O facility well, only lead has been detected above the action limit, but it was determined that the occasional elevated lead levels are more likely attributable to the region's naturally occurring lead deposits.



Remedial Actions:

In 1991, EPA conducted a removal assessment and determined that dangerous levels of heavy metals and cyanide, contained in several hundred drums, tanks, and vats of plating process waste, threatened the surrounding population, surface waters, and groundwater. Waste materials included spent acidic stripping and rinse solutions, as well as caustic sludge byproduct wastes.

In 1992, EPA contractors segregated and staged 600 drums for disposal as part of the removal activities. EPA excavated and transported a total of 1,220 tons of contaminated soil to an off-site landfill. EPA restored the site with 750 cubic yards of topsoil, followed by grass seed and straw. EPA decontaminated 50 tons of scrap metal on site and shipped it to a local scrap dealer. EPA shredded contaminated scrap wood (mostly pallets) on site and blended the resulting material with contaminated soil for disposal. EPA sandblasted and pressure washed the former on-site operations building. Twenty thousand gallons of generated wastewater were disposed of offsite.

The annual Registry site inspections identified stressed vegetation on the building's east side after the EPA removal action. On April 21, 2003, the Department conducted soil sampling that showed low concentrations of metals, pentachlorophenol (PCP), and toluene on the former processing building's east side.

On March 16, 2022, the Department conducted the FY22 annual inspection, during which the inspector noted nothing of significance.

General Geologic and Hydrologic Settings:

The site is located on a ridgetop where the topography is nearly flat to gently sloping. Surface runoff flows to Dry Branch or to another unnamed tributary of Shoal Creek. Shoal Creek, which is a gaining stream, is located about 1.5 miles northwest of the site. Many of the tributaries to Shoal Creek lose flow to the subsurface.

Surficial materials are expected to be 30 to 40 feet thick and consist mainly of cherty, red clay residuum. The residuum is a weathered product of the underlying cherty limestone bedrock and typically exhibits a moderate to high permeability. The residuum's chert content varies, but it is often present as a relict structure, retaining its stratigraphic position.

Bedrock beneath the site is Mississippian-age Burlington-Keokuk Limestone, a medium- to coarse-grained limestone with chert beds and nodules. Weathering of the bedrock has resulted in solution-enlarged fractures, bedding planes, caves, sinkholes, and springs. Such karst features have been observed in the area, but are not known to exist beneath the site.

The uppermost aquifer comprises the Burlington-Keokuk Limestone and the underlying Elsey and Reeds Spring formations. All of these units are cherty limestone. Together, these units have a thickness of about 265 feet beneath the site. Shallow groundwater flow is expected to be to the northwest toward Shoal Creek. Most private water supply wells use the uppermost aquifer. The upper aquifer is separated from the lower aquifer by a confining unit composed of the Mississippian Northview Formation and Compton Limestone and the Devonian Chattanooga Shale. The lower aquifer includes Cambrian and Ordovician formations composed of sandstones and cherty dolomites. Water wells that require higher yields, such as community wells, must tap the deeper aquifer, which is hundreds of feet thick.

Public Drinking Water Advisory:

The nearest public water well to this site is more than 1 mile south and serves a church. No site-related impacts are expected.

Health Assessment:

The contaminants of concern at this site are heavy metals. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Following the contamination removal and site cleanup, cadmium levels exceeding the site soil action level

were detected only in the concrete sampled from the walls and floors of the sludge storage vats. If the concrete does not stay intact, exposure to contaminants may occur via ingestion, inhalation, and dermal contact with contaminated dust.

In April 2001, the Missouri Department of Health and Senior Services (DHSS) sampled the on-site residential well, located less than 200 feet west of the former R&O operations building, and detected lead, cadmium, and zinc. Only lead and cadmium levels exceeded EPA action limits of 15 parts per billion (ppb) for lead and 5 ppb for cadmium. Those detections are most likely due to the past electro-plating operations. Cadmium and lead are present at elevated levels in other local groundwater samples, and may be attributable to past mining in the area. In August 2013, DHSS tested the on-site well again and did not detect lead nor cadmium.

In 2003, DHSS sampled seven wells in this area for metals. Only lead was detected above the action level in one sample at 24 ppb. In 2005, DHSS sampled four wells in this area and found lead and cadmium exceeding action levels in one of the well samples. In 2011 and 2015, four residents authorized well sampling. These samples did not detect contaminants above established standards warranting cleanup action. In 2017, one private well was sampled, and only zinc was detected, but below action levels. In 2018, DHSS sampled one private well for cyanide, but it was not detected. The source of the lead and cadmium detections in the previous off-site private well samples is unknown, but may be attributable to past mining in the area.

Because the on-site building contained old processing baths, DHSS made recommendations on safely removing this building from the site and cleaning up the ground debris. The building was destroyed, and the debris is stored on site within its remaining foundation.

Based on available information, this site does not appear to present a significant public health risk. If conditions change, such that levels of heavy metals in groundwater rise above health standards, individuals using private wells could be at risk of adverse health effects. Although some homeowners refused sampling, DHSS recommends that area private well users continue to monitor their well water quality through annual testing.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Rheox, Inc.

Site Name: Rheox, Inc.

Classification: Class 4

Date of Registry Placement: April 14, 1992

Site Address: 5548 Manchester Ave., St. Louis, St. Louis City, MO

Present Property Owner: Elementis Specialties

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Lead

Quantity: Not determined

Site Description and Environmental Concern:

Beginning in the late 19th century, National Lead (NL Industries) operated a white lead manufacturing facility at the Rheox site property, providing white pigment for paint and other products. The company also produced lead sulphate and chromate products, as well as rheological agents. Due to past manufacturing processes, high concentrations of lead are present in on-site soil.

The privately-owned property is located in an 8.33-acre industrial and commercial area at the southwest corner of the intersection of Macklind and Manchester avenues in St. Louis. Bordered by railroad tracks to the north and south, it is a roughly rectangular parcel of flat land. The nearest residence is 500 feet northeast of the site. Several public parks are located within a 3-mile radius. The entire site is fenced to restrict access, and a security guard is on site.

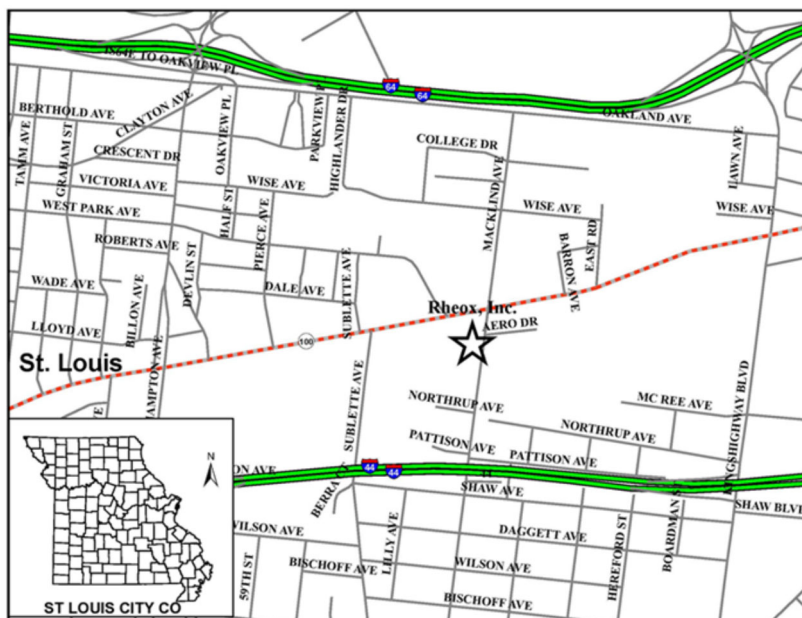
Lead-based pigment production at the site ceased around the time of World War II, when the company transitioned to lead chromate production. National Lead discontinued lead chromate production in 1990 and split off a division of the company as Rheox Inc. In 2000, Elementis Specialties acquired Rheox. Currently, the Elementis facility manufactures various surface-coating products.

High levels of lead are present in soil at the site. Elementis capped areas of high lead contamination with asphalt and concrete, and covered the entire parcel with impermeable surfaces. There is no risk of exposure to lead contamination at the site, as long as Elementis maintains these surfaces. Disturbance or deterioration of the cap, or removal/modification of on-site buildings, could cause direct exposure to lead contamination and result in migration of lead off site via surface runoff.

Remedial Actions:

During fall 1992, Rheox installed a cap consisting of a layer of asphalt over an impermeable geofabric liner. Rheox placed the cap across the eastern third of the parcel where no buildings are located. The owners have not conducted any additional remedial actions at the site. The Missouri Department of Natural Resources (Department) has approved several change-of-use requests at the site to allow for subsurface utility work and property improvements. On March 23, 2022, the Department conducted the Fiscal Year 2022 annual inspection during which inspectors noted nothing of significance.

General Geologic and Hydrologic Settings:



The Rheox site is situated in an industrial corridor next to River des Peres, a Mississippi River tributary. As the city grew, the river channel was straightened and the riverbed paved. It is now the main channel for the St. Louis City storm sewer system. Railroad tracks separate the site from the concrete banks of River des Peres. The site is level, with only 4 feet of total surface relief. Surface runoff flows into the river or into storm sewer inlets that feed the river.

Lead contamination likely is concentrated in fill material, which averages 6 feet thick across the site. The underlying natural soils are clay-rich, with moderate to low permeability. Perched water is present commonly at the fill-soil interface.

Although site-specific boring information is not available, bedrock is expected to be the Pennsylvanian-age Cheltenham Formation. The Cheltenham Formation comprises consolidated clays with thin, interbedded coal beds. Clay and coal were mined from most of the surrounding area. Open or water-filled mine cavities may be present under portions of the site. Mine deterioration has created several collapse features just south of the site, and engineering problems associated with mining still exist today. Groundwater recharge to the bedrock is limited. Under present site conditions, groundwater supplies do not appear to be threatened by lead contamination.

Groundwater from bedrock aquifers in St. Louis generally is high in dissolved solids, and no known water wells are in the site's vicinity.

The main concern is the potential for direct exposure to the contaminated material or off-site migration of lead contaminants via surface water runoff. Mobilized lead or lead-contaminated soil particles entering River des Peres may be deposited in sediment traps downstream, or may eventually reach the Mississippi River, about 8 miles downstream of the site.

Public Drinking Water Advisory:

The city of St. Louis obtains water from the Missouri and Mississippi rivers. No site-related impacts to public water supplies are expected.

Health Assessment:

Lead is the primary contaminant of concern at the site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

Lead contamination at the site is located in the subsurface and covered by asphalt, concrete, and building structures, which prohibit direct contact with the contamination. The area does not rely on groundwater for public drinking water, as a public water system serves the area, obtaining surface water from intakes on the Mississippi and Missouri rivers.

No exposure pathways are complete. This site is fenced and gated to restrict public access. Based on the available information, this site does not appear to present a significant public health risk at this time. This could change if excavation were to occur or if the asphalt cap deteriorates.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Riverfront Landfill

Site Name: Riverfront Landfill

Classification: Class 4

Date of Registry Placement: January 14, 1984

Site Address: Levee Road at Chouteau along the south bank of the Missouri River from River Mile 363.5 to 359.0, Kansas City, Jackson County, Missouri, NW 1/4, Sec. 27; SE 1/4, Sec. 22; N 1/2, Sec. 17; N 1/2, Sec. 16; SW 1/4, NW 1/4, NE 1/4, and SW 1/4, Sec. 15, T50N, R33W, North Kansas City Quadrangle

Present Property Owner: city of Kansas City

Lead Agency: United States Environmental Protection Agency (EPA)

Waste Type: Metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs)

Quantity: Not determined

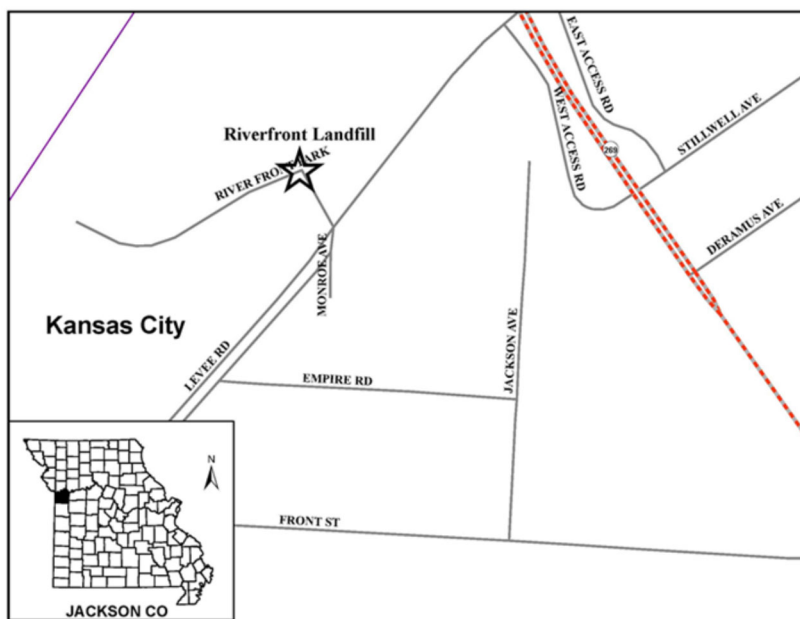
Site Description and Environmental Concern:

The Riverfront Landfill site formerly operated as an unregulated landfill for domestic and a variety of industrial waste types including: construction, demolition, non-infectious hospital, power plant, general chemical, paint sludge, polishing solvents, and electroplating wastes. Because of these past disposal practices, metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs) are present in surface soil.

The site is located on the south bank flood plain of the Missouri River in Kansas City, Missouri, and extends southward to the U.S. Army Corps of Engineers' East Bottoms Levee. This levee is set back approximately 1,000 feet from the riverbank and runs the entire length of the site. The site extends eastward from a point about 4,000 feet southwest of the Chouteau Trafficway Bridge to a drainage swale adjacent to the Harry S Truman Bridge. The site is approximately 1,000 feet wide by 3.5 miles long and covers an area of approximately 420 acres.

From 1950 to 1972, the Kansas City Public Works Department operated the site as a landfill. Until 1963, waste disposed of at the site was unregulated, and the city kept inadequate records on the waste materials the landfill accepted. In 1968, due to prohibition of open burning and backyard incinerations, an estimated 150,000 domestic burn barrels had been disposed of at the site. After 1968, only domestic waste and demolition debris were accepted. In November 1985, the Kansas City Parks and Recreation Department closed the Riverfront Landfill.

As was common practice in solid waste disposal during the 1950-1972 period, the landfill operated without liners, leachate controls, or multilayer final covers. Burning, in combination with land disposal, was the customary practice. The landfill placed solid waste in shallow trenches or pits, and often burned and eventually covered with available soil. The landfill treated liquid waste in a similar manner. Burning of liquid waste, specifically polychlorinated dibenzofurans, may have resulted in polychlorinated biphenyls, which are



environmentally persistent. Most cover soils were composed of silt and sand.

Excavating soil to the water table and having no landfill liner may contribute to infiltrating materials contaminating groundwater. Local industries use the groundwater for their processes. Surface runoff is toward the Missouri River.

Remedial Actions:

In June 1981, the city of Kansas City notified the U.S. Environmental Protection Agency (EPA) that the site might contain hazardous waste. In 1982 in response to this notification, EPA conducted a preliminary site investigation of surface and subsurface soil, and found inorganic metals at higher levels than the expected range, and VOCs above detection limits. EPA also detected polychlorinated biphenyls at levels well below the 50 parts per million (ppm) Toxic Substances Control Act standards for old disposal sites.

For descriptive purposes during past studies, EPA divided the site into three areas. Area I lies to the west of the Chouteau Bridge, Area II is located between the Chouteau and I-435 bridges, and Area III lies to the east of the I-435 Bridge.

EPA installed shallow groundwater monitoring wells to investigate potential groundwater contamination. In 1983 and 1984, EPA performed additional studies, which resulted in a recommendation to close the site, including the developed public areas. In 1984, the city of Kansas City collected samples that indicated on-site soil concentrations of lead from 49 to 8,000 ppm. The health-based action level for lead in residential soil is 400 ppm.

In June 1987, EPA and the city signed an administrative order on consent to conduct a response investigation. In July 1987, EPA issued a separate Administrative Order on Consent under Section 3013 of the Resource Conservation and Recovery Act (RCRA) and Section 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to the city. The city was required pursuant to the order to conduct groundwater monitoring, keep the site closed to the public, and clean up or cap lead-contaminated soil once the groundwater monitoring was complete.

From 1987 to 2004, the city of Kansas City conducted several studies to assess on-site contamination levels. In January and April 1988, the city sampled groundwater at 18 monitoring wells. Sampling results showed arsenic, barium, chromium, lead, benzene, and vinyl chloride in groundwater at concentrations above EPA's drinking water standards, the maximum contaminant levels (MCL).

In February 1990, the city submitted a final Groundwater Investigation report for Riverfront Landfill, which included a groundwater risk assessment. The risk assessment concluded that, under conditions at that time, exposure to on-site groundwater and surface water contaminants did not present unacceptable risks to human health and the environment.

The principal concern at the site is the potential for direct human contact with contaminated surface soils. Investigations of Area I documented elevated lead levels in soil. The Missouri Department of Health and Senior Services (DHSS) agreed that the city of Kansas City's plan to cap areas of Riverfront Landfill showing lead concentrations above 500 ppm would be protective of human health and the environment, provided the site remains on the Registry.

In 1992, the city of Kansas City capped selected portions of Area I. The city also installed a chain-link fence on the west side of Area II, the east side of Area III, and south of the levee along both Area II and Area III. The flood of 1993 damaged the fence in some areas and affected the cap, and the city subsequently repaired both the fence and cap.

In 1995, EPA sent a "no further action letter" to the city of Kansas City with respect to lead leaching into the groundwater. The city continues to monitor on-site groundwater. The city enrolled the site in the Missouri Department of Natural Resources' (Department) Brownfields/Voluntary Cleanup Program, but withdrew it in 1999, having made no progress toward site characterization.

In 1999, the Department approved installation of a stormwater drain sewer through the landfill, and the installation of a stormwater pumping station in 2000. In 2003, the Department approved the city to refurbish

and reopen the boat ramp in Riverfront Park, which provides access to the Missouri River.

In 2004, the city of Kansas City conducted an additional investigation in Area I of Riverfront Park to evaluate the current conditions with respect to the park's limited use during the June-July 2004 Lewis and Clark celebration. The investigation included collecting surface soil samples for lead analysis and surveying the surface and subsurface for methane. The Department and DHSS agreed that the results of the surface soil lead sampling would be compared to Cleanup Levels for Missouri Soil Target Concentration for lead under Scenario A (residential use) of 260 ppm. With the exception of one sample, none of the lead concentrations detected in the surface soil samples from the 2004 sampling event exceeded the action level of 260 ppm. Lead was detected at 320 ppm in the sample from the park area's southwest corner, in a wooded area south of the access road to the boat ramp. There is no vehicle access to this area, and it is not suitable for camping. Levels of methane detected in all samples from all aspects of the investigation were well below applicable guidelines.

The Department is assisting the city in developing a master plan for the site, which includes creating a recreational green space. The city characterized all areas of the site and did not find any compounds at levels that would prohibit recreational use.

On May 18, 2022, the Department completed the Fiscal Year 2022 Registry annual inspection, documenting that the site appeared well maintained. The city mowed the grassy area, and the access road on the levee is in good condition. Trees provide erosion control and are located closer to the river.

General Geologic and Hydrologic Setting:

The site is on the Missouri River flood plain. Soil texture may range from clay to sand, but for the most part it is predominantly coarse material with moderate to high permeability.

The site sits directly atop the Missouri River alluvium, which is an important groundwater source for the area. The Pennsylvanian-age Kansas City Group underlies the alluvium, which is composed of interbedded limestones and shales with low to moderate permeability. Surface infiltration from rainfall and runoff from adjacent areas, as well as floodwaters from the river during high stages, recharge the alluvium. Surrounding and underlying bedrock may also recharge this area. Under normal flow conditions, groundwater flow is toward or parallel to the river. Under abnormally high flow conditions, groundwater flow may be away from the river.

Public Drinking Water Advisory:

No public water sources are located near this site. The city of Independence's well field is approximately 4 miles downstream of the site and draws from the Missouri River alluvium, but no site-related impacts are expected.

Health Assessment:

The contaminants of concern at this site are: benzene, beryllium, bromodichloromethane, chlorobenzene, chloroform, chromium, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethene, ethylbenzene, lead, mercury, selenium, 1,1,2,2-tetrachloroethane, toluene, 1,1,2-trichloroethane, trichloroethene, and vinyl chloride. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

DHSS does not expect a site-related health risk since exposure is not occurring. If site conditions change in a way that makes exposure to contaminated soils possible, increased risk of adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Syntex - Verona (East)

Site Name: Syntex - Verona (East)

Classification: Class 4

Date of Registry Placement: January 1, 1984

Date of NPL Listing: September 8, 1983

Site Address: 299 Extension Street,
Verona, Lawrence County, MO

Present Property Owner: BCP
Ingredients, Inc.

Lead Agency: United States
Environmental Protection Agency (EPA)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-
dioxin (TCDD)

Quantity: Not determined

Site Description and Environmental Concern:

The Syntex – Verona (East) site is an active chemical production facility primarily utilized for choline production and ethylene oxide repackaging. Historically, the site produced hexachlorophene and one component for Agent Orange, a Vietnam-era defoliant. Production of these compounds resulted in the formation of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin) as a by-product. Soils and groundwater are the primary media of concern for dioxin contamination at the site.

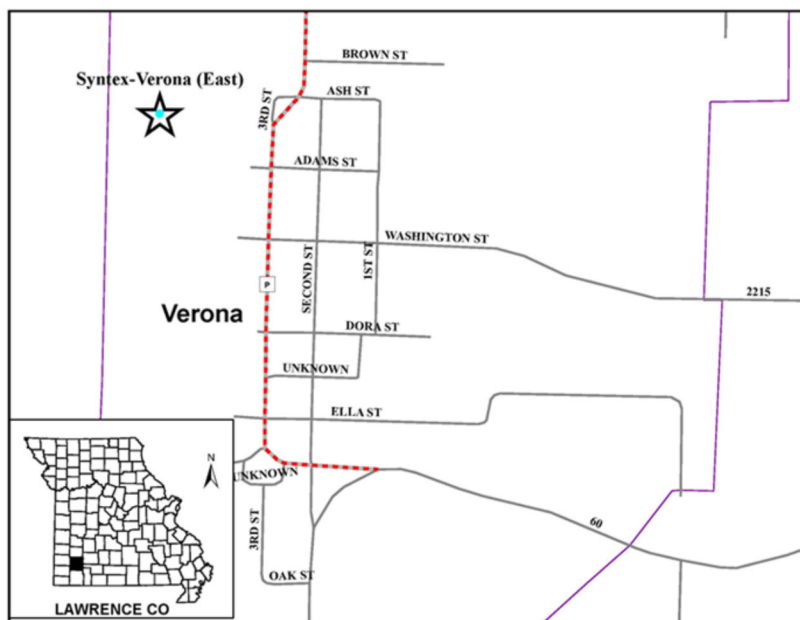
The privately owned facility consists of approximately 100 acres along the eastern bank of the Spring River, within the 100-year flood plain. Private residences are located to the east of the site, separated by railroad tracks. BNSF Railway services the railroad tracks. The facility consists of office space, manufacturing areas, above-ground storage tanks, parking areas, grassy areas, and a rail spur.

Chemical production and manufacturing has occurred at the facility since 1961. Several owners and operators have occupied the facility since it was constructed. The Agent Orange production, which created dioxin as a by-product waste stream, occurred from approximately May 1968 to January 1972. In 1978, the U.S. Environmental Protection Agency (EPA) first identified dioxin in fish tissue samples collected from the Spring River.

EPA and Missouri Department of Natural Resources (Department) investigations have delineated the nature and extent of the dioxin contamination. Remediation activities, including soil excavation and thermal treatment, are complete. EPA conducts groundwater monitoring and inspections on a regular basis. These monitoring activities do not show unacceptable risks to industrial workers or short-term contract workers at the site.

Remedial Actions:

From 1988 to 1990, Syntex conducted on-site remedial actions under EPA oversight and in accordance with the 1988 Record of Decision. Remedial actions included excavating TCDD-contaminated soils, decontaminating and disposing of TCDD-contaminated equipment, off-site thermal treatment of excavated



soils and cleaning solutions, and establishing and maintaining of vegetative soil covers over areas exceeding TCDD threshold levels.

The site's remediated areas include a lagoon area, spray irrigation areas, a slough area, a PCB spill area, and a T-1 Dike area. These areas do not contain levels of TCDD greater than 20 parts per billion (ppb), based on the EPA-approved Facility Implementation Plan and standard sampling methodologies.

Starting in 1970, North Eastern Pharmaceuticals and Chemicals Company (NEPACCO) operated a drum storage area in the plant site's northeast end that consisted of an enclosed building on a concrete slab. NEPACCO used the drum storage area until August 1996 to temporarily store hazardous waste. NEPACCO subsequently closed the drum storage area in accordance with a Department-approved Closure Plan (dated Oct. 2, 1996) by removing all waste material, the storage building, and concrete slab, and sampling soil underneath the former building. The soil sampling documented residual contamination below health-based levels at the time. In June 1997, NEPACCO submitted an Interim Closure Documentation Report.

In August 1996, Syntex sold the manufacturing plant and surrounding property east of the Spring River to DuCoa, an animal nutrition company. As part of the property sale, Syntex and DuCoa agreed to file a General Warranty Deed, recorded in September 1996, which restricts the site to industrial uses. In November 1997, Syntex filed another Deed Notice on the site's DuCoa-owned portion to advise any potential property purchaser that residual cadmium, lead, and mercury contamination was present above background concentrations, but below health-based levels, in soils near the former drum storage area. In June 1998, Syntex filed another Deed Notice for the former drum storage area to define the horizontal and vertical extent of residual soil contamination. In 2001, DuCoa sold the site to BCP Ingredients Inc. (BCP), another animal nutrition company, but Syntex remains responsible for continued investigation and monitoring at the site.

After Syntex conducted the remedial action for soils, groundwater, and surface water, EPA determined that site conditions were protective of human health and the environment. However, after conducting its 2012 and 2017 Five-Year Reviews (FYRs), EPA concluded that the remedy's overall protectiveness could not be determined without additional information. This was due to changes in risk assessment methodology, assumptions, and toxicity values that occurred after selecting the remedy.

In September 2016, to address the issues identified in the 2012 FYR, Syntex entered into an Administrative Order on Consent (AOC) with EPA. The AOC's purpose is to direct Syntex to perform additional site investigations so that EPA can determine whether the remedy remains protective. The additional investigations included soil, sediment, and groundwater sampling; monitoring well installations; and, hydrogeological and geotechnical characterization. The 2016 AOC also included reassessment of human health and ecological risk using current methodology, assumptions, and toxicity values.

In 2017, with EPA oversight, Syntex began conducting the additional site characterization and risk assessment described in the AOC. EPA will continue to oversee Syntex's work to satisfy the AOC's requirements to address any data gaps. This work will continue until the remaining questions can be resolved and EPA can adequately evaluate the remedy's protectiveness of human health and the environment.

On Jan. 9, 2019, an Environmental Covenant (EC) covering the Syntex facility site's East Area went into effect. The EC ensures protection of human health and the environment for any land disturbances. The EC also requires the property owner to sample and assess the soils for dioxin, dioxin-related compounds, and polychlorinated biphenyls (PCBs), prior to disturbance or excavation. The EC also requires proper maintenance of asphalt and concrete-covered areas, and prohibits groundwater use at the site.

In 2019, EPA held two public availability sessions and participated in an open city council meeting to provide updates to the community about ongoing site activities performed by Syntex, under the 2016 AOC. Also in 2019, EPA initiated a large-scale, domestic drinking water well sampling program in response to investigations that identified 1,4-dioxane in the groundwater at the site and to address the public's concern that site contaminants might be present in their domestic drinking water wells. 1,4-Dioxane is soluble in water and does not readily biodegrade in the environment. In December 2019 and January 2020, EPA sampled more than 90 domestic wells serving residences and a church within 2 miles of the site.

EPA analyzed the water samples for 1,4-dioxane, as well as for other semi-volatile organic compounds

(SVOC), volatile organic compounds (VOC)s, dioxins, and dioxin-like compounds. EPA also sampled one small public water supply for 1,4-dioxane. 1,4-Dioxane was detected at low levels consistently in one domestic well, and at very low levels – near the laboratory detection limit – in two other domestic wells. EPA determined there were no impacts to the domestic wells by site-related contaminants above the relevant EPA health-based standards.

On Dec. 9, 2021, EPA held a public availability session in Verona, Missouri, to update the public on recent Site activities, and to announce they were in the process of conducting the next FYR.

On June 28, 2022, the Department completed the Fiscal Year 2022 Registry annual inspection, during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located on the Spring River flood plain, which features numerous abandoned meanders. The meanders consist of gravelly materials, having a higher permeability than the surrounding materials. A portion of the site sits atop an abandoned channel that was filled prior to plant construction.

Two bedrock aquifers are present at the site: the shallow Mississippian limestone aquifer, called the Springfield Plateau Aquifer, and a deeper aquifer made up of Cambrian- and Ordovician-age carbonates and sandstones called the Ozark Aquifer.

The Springfield Plateau Aquifer is made up of cherty limestone that directly underlie the alluvium. This aquifer supplies limited yields to shallow wells and is subject to contamination from local sources, such as septic tanks and agricultural runoff, either through permeable soil and bedrock or through poorly-cased wells. At this site, the alluvial materials and the Mississippian bedrock are connected hydraulically. Shallow groundwater flow is generally north-northwest toward the Spring River.

The Ozark Aquifer, present typically at depths greater than 300 to 400 feet, supplies water to major industrial and municipal users and individual landowners in the area. In general, the Ozark Aquifer in this region of the state has not been affected greatly by surface contamination; however, some localized pollution has resulted because of poorly-cased deep wells that penetrate both the upper and lower aquifers.

Public Drinking Water Advisory:

The closest public water well to this site lies about 0.5 mile east of the city of Verona and serves a small subdivision. The well is cased to 360 feet deep, draws from the deep Ozark Aquifer, and site-related impacts are unlikely. The combined Aurora-Verona public water system also uses deep wells to draw water from the Ozark Aquifer, but the closest well to this site is more than 2 miles to the east-northeast. No site-related impacts are expected.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

Potential routes of exposure include direct exposure to the contaminated soil or inhalation of contaminated dust. Access to the site over land is limited, but the site is potentially accessible via the Spring River. The Missouri Department of Health and Senior Services now considers fish taken from the Spring River safe to eat, because sampling has shown that TCDD levels are no longer of health concern.

In December 2019 and January 2020, EPA sampled more than 90 domestic wells serving residences and a church within 2 miles of the site. These domestic drinking water wells were sampled for 1,4-dioxane, other SVOCs, VOCs, dioxins, and dioxin-like compounds. This sampling event did not identify any wells impacted above health-based standards. Based on available information, this site poses minimal risk as long as the environmental covenants remain in place.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Trenton Landfill

Site Name: Trenton Landfill

Classification: Class 4

Date of Registry Placement: June 10, 1992

Site Address: Northeast of Trenton, east of Highway 65 in Grundy County, Missouri, NE 1/4, NW 1/4, Sec. 10, T61N, R24W, Trenton Quadrangle

Present Property Owner: Connie S. Gwinnup and Anthony Clifford Droz

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: Heavy metals, paint waste, and herbicides

Quantity: Not determined

Site Description and Environmental Concern:

The Trenton Landfill site is an inactive 40-acre sanitary landfill with heavy metal, paint waste, and herbicide contamination.

The privately-owned site is located 2 miles northeast of the city of Trenton. Currently, the property appears to be an open field, but the waste mass remains buried on-site. The owner planted native grasses, trees, and forbs as part of the site's stabilization. The property is located in a predominantly rural agricultural area. The site is fenced along the east and south sides, but is open along Muddy Creek to the west, and along the road to the north. The owner posted "No Trespass" signs. The nearest residence is located 270 feet north of the site.

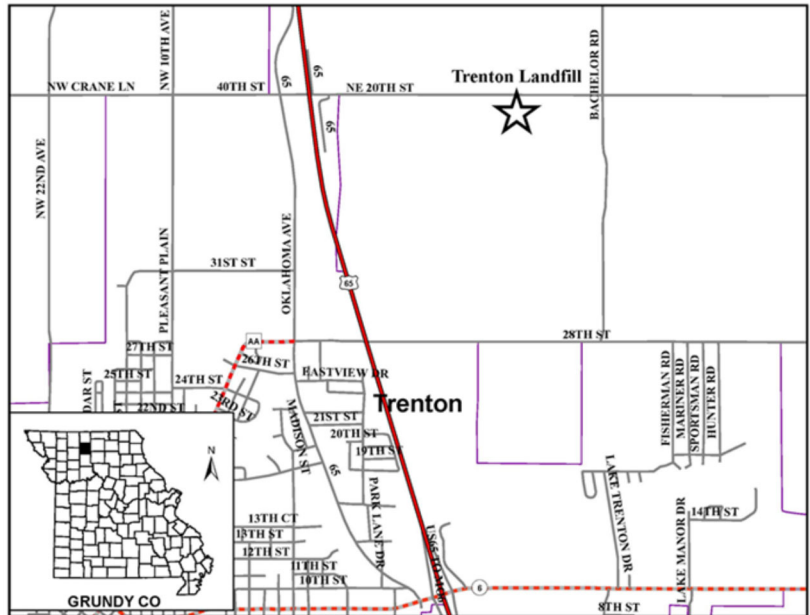
The city of Trenton used this site as a pre-law landfill from 1959 until 1975, when it received a Solid Waste Sanitary Landfill Permit (#107901). In 1979, the landfill ceased accepting waste. In 1980, the city of Trenton graded and seeded the area to prevent erosion off-site. In 1985, samples of Muddy Creek showed elevated levels of heavy metals downstream from the landfill. This discovery prompted the Missouri Department of Natural Resources (Department) to investigate the landfill as a potential contamination source. These investigations determined that a large quantity of hazardous waste had been disposed of at the site during the landfill's operation.

The site maintains a potential for off-site migration of waste constituents via shallow groundwater. Cap erosion and leachate outbreaks have also been a concern.

Remedial Actions:

The site has had a history of erosion, resulting in: exposed solid waste, hazardous substances, and hazardous waste; subsidence of the cap that caused ponding; and, leachate outbreaks that potentially entered Muddy Creek. The responsible parties have performed stabilization and repair work to address these issues.

In 2015, the city completed the most recent repair work, including fixing areas where all-terrain vehicles had



damaged the landfill cap. To address the damaged areas, the city pushed existing berms over into the areas of subsidence, then spread and compacted the existing soil. The city added off-site soil to create a clay cap that was 3 feet thick, with enough top soil added to support good vegetation. Woody vegetation was removed, but trees on the western edge were left intact to protect the stream bank and to uptake subsurface leachate. The site was graded, seeded, and mowed.

On Oct. 19, 2015, the Department conducted a closed sanitary landfill inspection. The Department observed a few areas of dead vegetation in the southwest and northeast corners, as well as along the eastern boundary. Additionally, mowing has exposed a few pieces of litter scattered throughout the landfill. During this 2015 closed sanitary landfill inspection, the Department did not observe evidence of continued ATV use or evidence of ponding of water on the landfill.

On May 9, 2017, the Department conducted a closed sanitary inspection and found the landfill in compliance.

On April 20, 2022, the Department conducted the Fiscal Year 2022 annual site inspection, during which inspectors observed evidence of recent repairs for ponding and erosion. The repaired areas will need seeding in order to prevent future erosion. The city of Trenton is addressing erosion issues as they appear.

General Geologic and Hydrologic Setting:

The Trenton Landfill is located in the Dissected Till Plains physiographic region of northern Missouri. The site is located on the western slope of a rolling upland adjoining Muddy Creek, which flows along the site's western boundary.

Much of Grundy County is covered by glacial drift, a heterogeneous, unconsolidated deposit of clay, sand, gravel, and boulders. Some of the sands in the lower layers of the till form permeable beds of limited lateral and vertical extent. These lenses are a source of poor-quality drinking water for several wells within 2 miles. The till underlying the site is expected to be more than 100 to 150 feet thick. Flow of any groundwater existing in the sand lenses of the lower till likely is to the southeast.

The fine-grained, low-permeability sediments beneath the site should retard the downward movement of surface water and leachate, reducing impacts to groundwater. However, if sand lenses are present in the till, contaminant movement and migration within groundwater will be enhanced.

Bedrock beneath the landfill is probably shale and sandstone of the Cherokee Group, which is about 435 feet thick at Trenton. Minor amounts of clay, coal, and limestone also occur in the Cherokee Group. In fact, an undulatory bed of coal was mined at the Trenton Mine, 1 mile southeast of the landfill. In general, the large shale content of most Cherokee strata greatly impedes the flow of groundwater. The basal member of the Cherokee Group is a water-bearing sandstone more than 100 feet thick. In southeast Grundy County, water from this layer is suitable for livestock; however, the bedrock aquifer's low yields and high dissolved-solids content make it unsuitable for most uses.

Public Drinking Water Advisory:

Trenton Municipal Utilities uses the Thompson River as a primary water source, and no site-related impacts are expected. Groundwater in the region is generally of poor quality, so shallow aquifer contamination is not a significant public health threat.

Health Assessment:

Landfill records indicate that numerous chemicals associated with waste oils, wastewater treatment sludge, heavy metal sludge, paint sludge, solvents, and acid cleaning solutions may be present in the landfill. At one time, high concentrations of metals were identified in Muddy Creek. The current chemical composition and concentration of chemicals and metals in the landfill soils, landfill runoff, and Muddy Creek's water and sediment are unknown.

Potential human exposure to site-related contamination may result from contact with surface water runoff, leachate, shallow groundwater, and surface water. Now that the site has a 3-foot-thick clay cap, potential human exposure to site-related contamination via exposed debris and subsurface and surface soils should

be very limited. Persons who could be directly exposed to site-related contaminants include trespassers and maintenance workers. Potential exposure to leachate within water and sediment of Muddy Creek includes recreational use and irrigation. The ephemeral nature of Muddy Creek may expose persons involved in recreational activities including swimming, wading, and fishing. Wildlife, livestock, and fish may become contaminated due to exposure to contaminated surface water adjacent to and downstream of the site. Heavy metals bioaccumulation in the aquatic food chain could contaminate fish, thus a potential exposure pathway exists via local fish consumption.

Exposure to contaminated groundwater used as a potable water source is not likely. Based upon geologic and hydrologic investigations, downward movement of contaminants is unlikely. The Missouri Department of Health and Senior Services did not find any private wells within 1 mile of the site.

Based on available information, direct exposure to this site does not appear to pose a significant public health threat at this time. Exposure to site-related contamination may occur through direct contact to leachate at the site and in Muddy Creek. Exposure is being minimized by increased maintenance of the site's soil cap and groundcover, fencing along the east and south sides, posting additional "No Trespass" signs, and having the sheriff's office patrol the area more regularly in an effort to keep trespassers out. Current risk of exposures to Muddy Creek sediment and fish are unknown. Testing surface water and sediment for site-related contamination may still be needed.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Turner Salvage (formerly Tonnar Salvage)

Site Name: Turner Salvage (formerly Tonnar Salvage)

Classification: Class 4

Date of Registry Placement: May 16, 1997

Site Address: 306 Business Hwy 24 East, Carrollton, Carroll County, MO

Present Property Owners: Advantage Metals Recycling, LLC

Lead Agency: United States Environmental Protection Agency (EPA)

Waste Type: Ignitable materials, volatile organic compounds (toluene, ethylbenzene, xylenes, 2-butanone, and benzene), trichloroethene (TCE), metals (chromium, lead and beryllium), polychlorinated biphenyl-containing transformers, and asbestos-containing materials

Quantity: Not determined

Site Description and Environmental Concern:

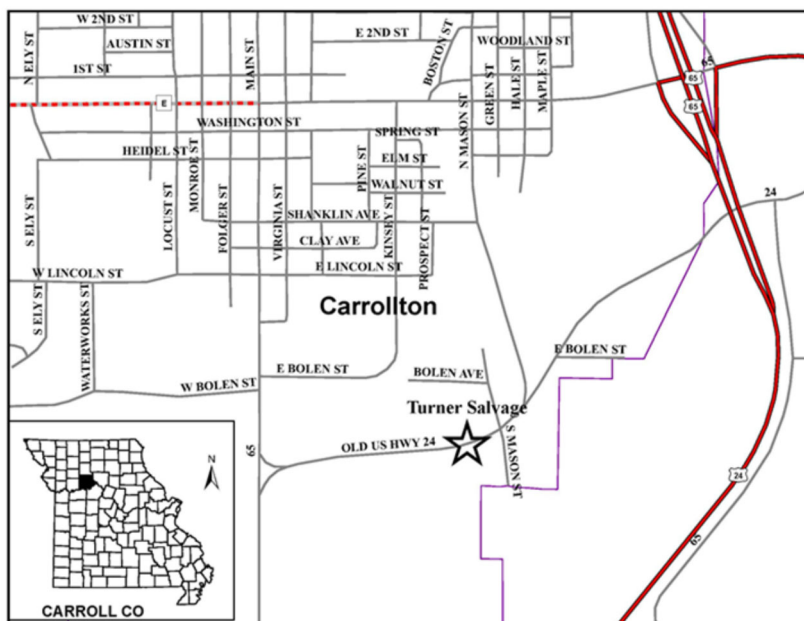
The Turner Salvage (formerly Tonnar Salvage) site is the location of a former salvage yard where the Missouri Department of Natural Resources (Department) identified containerized hazardous wastes, used oil, and lead-based paint on-site. The site is no longer an active salvage yard. Turner Salvage operated from 1957 until its closing in October 2008.

Turner Salvage is located on a 10-acre parcel of land in a commercial and residential area southeast of the city of Carrollton. The former salvage yard is now a vacant lot covered in vegetation. Advantage Metals Recycling LLC currently owns the Turner Salvage site. A private residence is located on the site's eastern border. Adams Primary Public School is located 0.75 mile north of the site. Penny's Concrete Inc. borders the site to the west. Old Highway 24 runs along the site's south border and the Burlington Northern and Santa Fe Railroad borders the site to the north. Standley Branch Creek bounds the Turner Salvage site on the south and east before discharging into Wakenda Creek, 0.25 mile from the site. Wetlands are associated with both waterways. The site is within the Missouri River's 10-year flood plain.

In March 1998, the Missouri Department of Natural Resources (Department) completed an Integrated Preliminary Assessment/Site Inspection on the Turner Salvage site. The Department conducted sampling that revealed elevated lead contamination of surface soils in the site's northern half. The Department also found TCE, beryllium, total xylenes, and chromium in excess of health risk levels in surface soil. Sediments sampled downstream of the site contained elevated concentrations of lead compared to sediments upstream from the site. Groundwater collected beneath the site contained elevated concentrations of lead.

Remedial Actions:

In November 1997, the U.S. Environmental Protection Agency (EPA) and Turner Salvage entered into an Administrative Order on Consent for removal action. In December 1998, Turner Salvage conducted a removal action for containerized hazardous wastes, used oil, and lead-based paint, and disposed of the material off-site. Turner Salvage excavated, characterized, and transported isolated areas of oil-, lead-, and TCE-contaminated soils for disposal as nonhazardous wastes.



The oil spill area south of the Turner Salvage Garage remains an area of potential concern; it continues to show elevated total petroleum hydrocarbon levels. However, an asphalt surface underlays this area. Additional areas of concern include: an area between Buildings A and B with elevated beryllium levels, which were not addressed during the removal action; oil contamination near the compactor and baler, identified during the Department's annual inspection; an area near the site's west edge that is devoid of vegetation; and, a former transformer-processing area that EPA sampling determined contains polychlorinated biphenyls.

Turner Salvage removed and disposed of other nonhazardous solid wastes off-site, including asbestos-containing materials, empty drums and containers, and other miscellaneous materials. The owners removed and delivered three transformers to the city of Carrollton for reuse, as well as several compressed gas cylinders, which the city either reused or disposed of as appropriate. Numerous containers of asphalt sealer containing TCE were determined to be useable product and placed back into the facility's active inventory. Heritage Environmental removed additional containers of useable oil and grease.

Hazardous substances may remain on-site. However, on Sept. 25, 1998, the Department completed an expanded site investigation and recommended no further remedial action at Turner Salvage for the following reasons: no evidence was found of contaminants affecting nearby drinking water wells exists; no evidence was found of contaminants migrating to nearby wetlands and fisheries; and, site contamination had been addressed under a removal action. During an integrated Preliminary Assessment/Site Inspection, the Department collected shallow groundwater samples around the compactor and baler. These samples contained 181 parts per billion (ppb) lead, which exceeds the state's water quality standard and EPA's drinking water action limit for lead of 15 ppb. However, the 1998 Expanded Site Investigation found no evidence of impact to the private drinking water wells in the vicinity.

In 2000, EPA approved Turner's removal compliance report, documenting the removal action conducted under an Administrative Order on Consent. EPA plans no further remedial or removal actions.

During a May 2013 inspection, the Department noted the city of Carrollton had excavated a portion of the property's east side and installed a 30-inch sewer line and manholes. The city also had worked along the property's north portion. Soil stockpiles were located along the property's south portion, and the owner had conducted additional grading. Following the inspection, a sinkhole approximately 6 feet wide by 6 feet deep had opened up in the property's north-central portion due to a compromised active sewer line. The top of the sewer line had collapsed and, over time, a sinkhole developed as the soil above the sewer line break eroded. By July 2013, the city of Carrollton had repaired the sewer line. The owner spread the soil stockpiles located along the south portion across the property and regraded, but did not remove soil from the site.

On April 20, 2022, the Department conducted the Fiscal Year 2022 annual site inspection, during which inspectors reported no significant changes at the site.

General Geologic and Hydrologic Setting:

The site is located on alluvium of the Missouri River floodplain. The 50- to 100-foot-thick alluvium consists of low-permeability, fine-grained clay and silt at the surface, grading with depth to coarser sand and gravel units with high permeability. Sand units are encountered typically within 20 feet below grade, and the gravel seams are present nearer the alluvium/bedrock contact. Depth to the water table is about 15 feet. The alluvial aquifer, which is an important source of potable water for local inhabitants, is in direct hydraulic communication with the Missouri River.

Under normal flow conditions, groundwater beneath the site flows south to southeast toward the Missouri River, while surface water runoff enters the Standley Branch of Wakenda Creek, a stream located south of the facility. Wakenda Creek, a gaining stream, may be in direct hydraulic communication with the Missouri River alluvial aquifer. The site is subject to occasional flooding from the creek and the river. Release of contaminants would readily affect the alluvial aquifer through direct infiltration.

The bedrock beneath the site is composed of Pennsylvanian-age limestones. Since the bedrock exhibits low permeability, release of contaminants would have minimal effect on the bedrock aquifer. Due to the mineralization of water within the bedrock, this aquifer is not used as a drinking water source. Release of dense non-aqueous phase liquids would be expected to impact the base of the alluvial aquifer, potentially

migrating along the top of bedrock, which slopes toward the southeast.

Public Drinking Water Advisory:

The city of Carrollton and Carroll County PWSD #1 draw water from Missouri River alluvium, which is a valuable local and regional water source. Carrollton has four wells, the closest two of which are located approximately 1.3 miles southwest of the site. The city's other two wells are more than 2 miles south-southwest of the site. Carroll County PWSD #1 uses two wells located more than 3 miles southeast of the site. Groundwater flow in the alluvial aquifer trends to the south-southeast (toward the Missouri River), except when river levels are high, at which time the flow may direct north and northwest. Site-related contamination is unlikely to impact any of these wells.

Health Assessment:

The primary contaminants of concern are: polychlorinated biphenyls, asbestos, toluene, ethylbenzene, xylene, 2-butanone, chromium, beryllium, lead, TCE, and xylene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

A determination was made that contaminants are not migrating to the municipal water supply. However, because of the uncontrolled nature of the wastes, this site may continue to present a public health threat. The site borders a stream, is near a wetland, and is in the Missouri River floodplain. Waste has been placed right up to the stream bank. Municipal wells are located within 1 mile. As a result of these conditions, surface water, groundwater, sediment, and soils are all potential exposure media, and thus pose a potential health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Union Carbide

Site Name: Union Carbide

Classification: Class 4

Date of Registry Placement: December 12, 1996

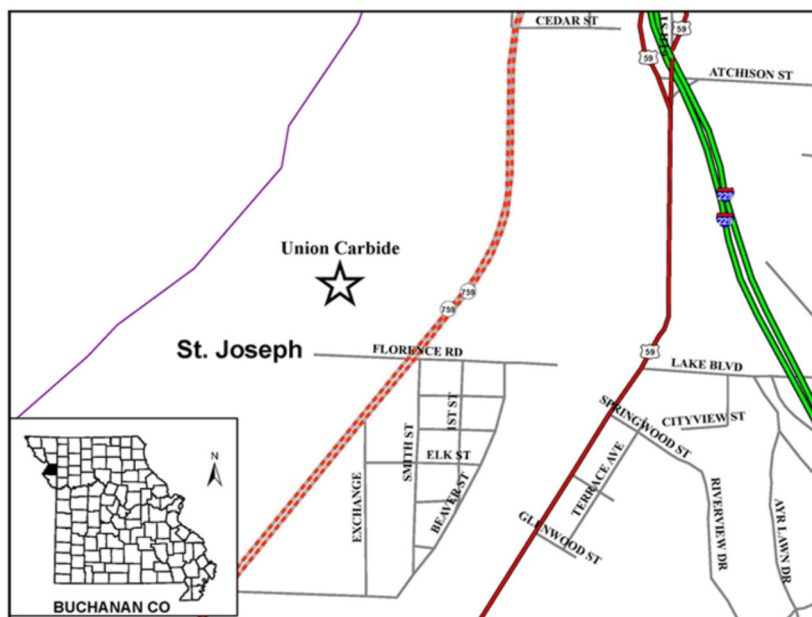
Site Address: 317 W. Florence Road, St. Joseph, Buchanan County, MO

Present Property Owner: Union Carbide Corporation

Lead Agency: Missouri Department of Natural Resources (Department)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined



Site Description and Environmental Concern:

The Union Carbide site is an herbicide blending facility where 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) were used as active ingredients to formulate herbicides beginning in the 1970s. Because of past herbicide blending on site, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD or dioxin) contamination is present in on-site soils.

Union Carbide owns 5.3 vacant acres, of which 3.8 acres remain on the registry. In 1956, Amchem Products began formulating herbicides and producing metal works on a 7.84-acre property in St. Joseph, of which the Union Carbide site occupies 5.3 acres today. Amchem formulated herbicides using the active ingredients 2,4-D and 2,4,5-T until 1975. These formulations sometimes produced the unwanted byproduct TCDD.

Soon thereafter, Union Carbide purchased the property and began formulating other herbicides. In 1986, Rhone-Poulenc, a chemical and pharmaceutical company, bought the herbicide formulation facility. The company acquired only the 2.5-acre property containing the facility. Union Carbide retained the remaining 5.34 vacant acres, of which only 3.80 acres remain on the registry. In December 1997, Rhone-Poulenc sold the adjacent 2.5-acre property and facility to agricultural chemical company Nufarm Inc., which is a separate registry site.

On-site contamination dates from between 1956 and 1975, when Amchem formulated herbicides containing TCDD. The site owners filled in the lagoon that Amchem used for waste disposal from 1956 until 1975, but it remains a source of contamination on the property retained by Union Carbide.

The Union Carbide site is capped, well vegetated with grass, and enclosed by a 6-foot, chain-link fence with barbed wire at the top. The former lagoon area is only accessible by crossing through the fenced and gated Nufarm site property. The site is located in the Missouri River flood plain. Railroad tracks lie between the site and the Missouri River, which is about 50 yards from the site's western boundary. The site is located in a heavily industrialized area, and access is controlled. Residential areas are located less than 0.5 mile southeast and less than one mile north.

Remedial Actions:

In 1975, Amchem drained and filled the lagoon. Water samples that Amchem collected from the lagoon prior to

its closure revealed only traces of heavy metals and phenols. Amchem took no further actions at that time.

In a 1983 Resource Conservation Recovery Act inspection report, the Department recommended that Union Carbide resample the lagoon. In 1986, the U.S. Environmental Protection Agency (EPA) conducted sampling of the former lagoon. Individual soil grab samples revealed concentrations of dioxins (including TCDD) as high as 49 parts per billion (ppb) at the surface. In 1988, Union Carbide contracted Pacific Environmental Services to conduct more extensive sampling, which detected TCDD at concentrations as high as 16 ppb (0-6 inches) and 76 ppb (6-20 inches) in the composite soil samples.

In December 1997, Union Carbide petitioned the Department for a change in site classification. To evaluate the Union Carbide request, the Department required further site investigation and remediation. In October 1998, Union Carbide conducted environmental sampling, including collection of three groundwater monitoring well samples and two sediment samples. The samples were analyzed for 2,4-D; 2,4,5-T; Silvex (2,4,5-trichlorophenoxypropionic acid), and TCDD. None of the sample results exceeded regulatory limits for any of the contaminants of concern. Therefore, the Department reclassified the site as a Class 3 site.

In June 2001, the Department approved Union Carbide's cap work plan. In July 2002, Union Carbide completed the remedial construction project, which consisted of laying a drain pipe in the storm water ditch on the east side, placing a 1- to 2-foot-thick compacted clay cap over the contaminated area, installing a 10-foot wide clay apron around the clay cap's perimeter, and installing a 6-inch topsoil layer over the cap to support a vegetative cover. Union Carbide also moved a fence to correspond with the southern property boundary. Union Carbide committed to conducting ongoing maintenance and inspections of the cap and vegetative cover. Survey markers installed by Union Carbide delineate the cap, cap apron, and buffer zones.

Following the cap's construction in 2002, the Department reclassified the site to a Class 4 to reflect the reduced risk of exposure.

In fall 2002, the Department approved a Union Carbide request to reduce the area of the site listed on the registry to the surveyed 3.80-acre area that includes the cap, cap apron, and buffer zones. The Department removed the 1.54-acre area to the north of the cap from the registry after Union Carbide sampling confirmed that hazardous wastes are not located on that portion of the property. Union Carbide has not conducted any additional remedial actions since the Department reduced the area in 2002.

On March 22, 2022, the Department conducted the Fiscal Year 2022 annual inspection concurrently with the annual inspection of the adjacent Nufarm site, during which inspectors noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located on alluvium of the Missouri River floodplain. The 60- to 100-foot-thick alluvium consists of low-permeability, fine-grained clay and silt at the surface, grading with depth to coarser sand and gravel units with high permeability. Sand units typically are located within 20 feet below grade, and the gravel seams are present nearer the alluvium/bedrock contact. Depth to the water table is 10 to 20 feet. The alluvial aquifer, which is an important source of water for local industry, is in direct hydraulic communication with the Missouri River.

Under normal flow conditions, groundwater beneath the site flows west toward the Missouri River. The river occasionally floods the site, and high river stages could reverse the groundwater flow's direction. High-yield wells near the site may also affect the groundwater flow's direction. Contaminant releases could affect the alluvial aquifer through direct infiltration.

The bedrock beneath the site is composed of Pennsylvanian-age limestone. Since the bedrock exhibits low permeability, contaminant releases would have minimal effect on the bedrock aquifer. Due to the mineralization of water within the bedrock, this aquifer is not used as a water source.

Public Drinking Water Advisory:

The city of St. Joseph obtains water from alluvial wells along the Missouri River, which are unaffected by this site. No impacts to public water sources are expected.

Health Assessment:

The chemicals of concern at this site are TCDD and Silvex. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Currently, little opportunity for exposure exists, because Union Carbide has capped, vegetated, and fenced the site. Based on available information, no health risk is expected as long as the cap remains intact.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

**APPENDIX A
HEALTH ASSESSMENT
CHEMICAL TABLE**

HEALTH ASSESSMENT CHEMICAL TABLE

CHEMICAL	POSSIBLE HEALTH EFFECTS
Acetone	Irritant to eyes, skin, respiratory system, central nervous system (CNS) depressant. May cause dizziness, headache, nausea and vomiting.
Actinium	Occurs naturally through the decay of uranium minerals. See Uranium health effects
Alachlor (Lasso)	Probable human carcinogen; known animal carcinogen. May cause liver damage, skin irritation and irreversible eye damage.
Aldrin	Probable human carcinogen; animal teratogen. Targets CNS, liver, kidneys, and skin. May cause headache, dizziness, irritability, vomiting and uncontrolled muscle movements.
Aluminum	Replaces calcium in bone, implicated in Alzheimer's disease. May cause eye and upper respiratory irritation. May affect CNS.
Anthracene	Respiratory irritation and skin damage.
Antimony	Probable human carcinogen; animal carcinogen. May cause irritation of eyes and lungs, heart problems, stomach pain and ulcers, diarrhea, and vomiting.
Arsenic	Known human carcinogen. May cause skin irritation, digestive system disturbances, decreased production of red and white blood cells, and abnormal heart rhythm.
Atrazine	Possible human carcinogen. May cause heart, liver, kidney, peripheral nervous system damage, and decreased sperm concentration and mobility.
Barium	Targets respiratory system, CNS. May cause abdominal cramps, difficulty breathing, vomiting, and diarrhea.
Benzene	Known human carcinogen; animal carcinogen; suspected animal teratogen. May cause drowsiness, headaches, rapid heart rate, confusion, decrease in red blood cells, and affect the immune system.
Benzo(a)anthracene	Probable human carcinogen. Targets respiratory system, skin, bladder, and kidneys.
Benzo(a)pyrene	Probable human carcinogen. Targets respiratory system, skin, bladder, and kidneys. May cause reduced birth weight, neurobehavioral effects, and decreased fertility.
Benzo(b)fluoranthene	Probable human carcinogen. Targets skin, lungs, and urinary tract.
Benzo(ghi)perylene	Insufficient data.
Benzo(k)fluoranthene	Probable human carcinogen.
3,4-Benzofluoranthene	Insufficient data.
Benzoic acid	Targets eyes, skin, and mucous membranes.
Beryllium	Known human and animal carcinogen. Targets lungs, heart, liver, kidneys, spleen, skin, and eyes.

Beta-hexachlorocyclohexane	Possible human carcinogen. May cause CNS depression.
Bis (2-ethylhexyl) phthalate	Known animal carcinogen; probable human carcinogen. May cause respiratory and gastrointestinal illness.
Bromodichloromethane	Suspected animal carcinogen; possible human carcinogen.
2-Butanone	Targets the lungs, nose, throat, eyes, skin, and CNS.
Butyl benzyl phthalate	Possible human carcinogen.
Cadmium	Probable human carcinogen, animal teratogen. Attacks lungs, kidneys, blood, and irritates the stomach. May cause aching pains in back and limbs, chills, and generalized weakness.
Carbon Tetrachloride	Known animal carcinogen; probable human carcinogen. Targets liver, kidneys, and CNS.
Chlordane	Known human and animal carcinogen. Targets CNS, digestive system, eyes, lungs, liver, kidneys and skin. May cause headache, irritability, vision problems, weakness, jaundice, seizures, and coma.
Chlorobenzene	CNS depressant; attacks lungs, liver and kidneys. May cause headache, nausea, labored breathing and sleepiness.
Chlorodibromomethane	Possible human carcinogen. May cause CNS functional disturbances.
Chloroform	Known human carcinogen. Hepatic and renal damage and CNS depressant. May cause dizziness, fatigue, headache, and skin sores.
Chromium	Chromium (VI) is a known human carcinogen respiratory system damage; liver and kidney effects; toxic effects vary with valence state. May cause irritation to the skin, digestive system, and damage to the male reproductive system. Inadequate evidence in humans for carcinogenicity of metallic chromium and chromium (III) compounds.
Chrysene	Known animal carcinogen; probable human carcinogen.
Cobalt	May cause asthma, pneumonia, wheezing, and contact dermatitis
Cyanide	CNS depression. May cause breathing difficulties, , headaches, chest pain, vomiting, enlargement of the thyroid gland, Digestive system disorders and cardiovascular damage.
2,4-D	Weakness, stupor, hyporeflexia, muscle twitching, convulsions, and dermatitis. Targets the liver, kidneys, and CNS. Insufficient data to determine human carcinogenicity.
DDT.DDD.DDE	Probable human and animal carcinogen. Targets nervous system, liver, kidneys, and skin.
Delta-hexachlorocyclohexane	May cause lung irritation, headache, and convulsions.
Dibenz(a,h)anthracene	Probable human carcinogen.
1,2-Dichlorobenzene	Targets liver, kidneys, skin, eyes, and respiratory system.

1,3-Dichlorobenzene	May cause irritation to eyes, nose and throat, stomach pain, nausea, vomiting, and diarrhea. May damage liver and kidney.
1,4-Dichlorobenzene	Possible human carcinogen; known animal carcinogen. Targets liver, kidneys, eyes, skin, and respiratory system.
3,3-Dichlorobenzidine	Known animal carcinogen; probable human carcinogen. May cause dermatitis, and respiratory infection.
1,1-Dichloroethane	Possible human carcinogen. CNS depressant; skin irritant; liver and kidney damage.
1,2-Dichloroethane	Probable human carcinogen; suspected animal teratogen. CNS depressant; digestive system disorders; respiratory and circulatory system damage.
1,2-Dichloroethene	CNS and respiratory depressant. May cause kidney, liver, and lung damage, nausea, drowsiness; skin and eye irritant.
2,4-Dichlorophenol	May cause mouth, throat, and stomach irritation; abdominal pain, pallor, sweating, weakness, headache, and dizziness.
Dieldrin	Probable human carcinogen, animal teratogen. Attacks CNS, liver, kidneys, & skin.
Diethyl phthalate	Respiratory, mucous membrane, and dermal irritant.
2,4-Dimethylphenol	Possible human carcinogen. May cause irritation of tissue and mucous membrane.
Di-n-butyl phthalate	Respiratory, mucous membrane, and dermal irritant.
Di-n-octyl phthalate	Suspected animal teratogen. May cause mucous membrane irritation.
1,3-DNB (explosive)	Probable human carcinogen. Targets CNS.
Endosulfan	CNS damage. May cause agitation, tremors and convulsions.
Endrin	Targets CNS and liver. May cause headaches, dizziness, confusions, nausea, vomiting, and convulsions.
Ethylbenzene	Renal and hepatic disorders. Chronic respiratory and dermal disease. CNS depressant. May cause throat, eye, and mucous membrane irritation.
Ethylene	Loss of coordination, unconsciousness, convulsions and paralysis. Targets eyes, skin, respiratory system, and CNS.
Ethylene dibromide	Probable human and animal carcinogen. Targets eyes, skin, respiratory system, liver, kidneys, and reproductive system.
Fluoranthene	Attacks urinary and hepatic systems.
Heptachlor	Probable animal carcinogen, probable human carcinogen. Targets CNS and liver.
Heptachlor epoxide	Probable human carcinogen. Targets CNS and liver.
Hexachlorobenzene	Possible human carcinogen; probable animal carcinogen. May cause weight loss, enlargement of the thyroid, skin sores, and discoloration. Liver, reproductive system and CNS effects.
Hexachlorophene	May cause nausea, vomiting, irritability, dehydration, and hypotension.

Indeno(1,2,3-cd)Pyrene	Probable human carcinogen. No known short-term health effects at this time.
Isophorone	Possible human carcinogen. Central nervous system depressant; dermal, eye, nose, and throat irritant. May cause nausea, headache, and dizziness.
Lead	Probable human carcinogen. Digestive system discomfort; muscular system weakness; CNS damage; affects blood and liver. No safe blood lead level in children has been identified. In children, lead exposure is associated with hyperactivity, attention and conduct problems, and impairment in cognition.
Lindane (Gamma-hexachlorocyclohexane)	Known animal carcinogen; Probable human carcinogen. Targets eyes, skin, respiratory system, blood, liver, kidneys, and CNS. May cause muscle and kidney necrosis, digestive tract inflammation, and hemorrhage.
Manganese	Known animal teratogen. Targets respiratory system, CNS, blood, lungs, and kidneys.
Mercury	Targets CNS, kidneys, respiratory tract, skin, and gingival tissue. May cause changes in vision and hearing, memory loss and tremors, digestive distress, increase in blood pressure or heart rate, skin rashes, and eye irritation.
Methoxychlor	CNS depressant. May cause nausea and headache.
Methylene Chloride	Probable human carcinogen and known animal carcinogen. May cause cardiovascular irregularities; CNS depressant.
Naphthalene	Known animal carcinogen; possible human carcinogen. May cause destruction of red blood cells, fatigue, loss of appetite, pale or yellow skin, digestive distress, and blood in urine.
Nickel	Known animal carcinogen, suspected animal teratogen; possible human carcinogen. CNS depressant; respiratory system damage; liver and kidney effects.
P-chloro-m-cresol	May cause mouth and throat irritation; pallor, sweating, weakness, headache and tinnitus. Skin exposure may cause contact eczema and pain followed by numbness
Pentachlorophenol	Probable human carcinogen; probable animal carcinogen. Irritation to skin, eyes, respiratory system; possible damage to liver and kidney. May cause increase in body temperature resulting in injury to various organs and tissues.
Phenanthrene	Suspected animal carcinogen; possible human carcinogen. Targets skin, bladder, kidneys, and respiratory system.
Phenol	Affects the digestive system, CNS, liver, and kidneys. May cause skin and eye damage.
Polychlorinated biphenyls	Animal carcinogen; probable human carcinogen; hepatotoxin and embryotoxin. May cause skin irritation (chloracne) and liver damage.
Polycyclic Aromatic Hydrocarbons (PAHs)	Certain PAHs radium are positive animal carcinogens and positive human carcinogens.
Pyrene	Known animal carcinogen; possible human carcinogen. Targets skin, bladder, kidneys, and respiratory system.

Radium	*Known human carcinogen. Series effects include lymphoma, bone cancer, and diseases that affect the formation of blood, such as leukemia and aplastic anemia. External exposure to radium's gamma radiation increases the risk of cancer to varying degrees in all tissues and organs.
RDX (explosive) 1,3,5-trinitro-1,3,5-triazine	Probable human carcinogen. CNS effects, such as seizures. May cause nausea, vomiting, eye and skin irritation, headache, irritability, fatigue, and insomnia.
Selenium	Targets CNS, liver, heart, and respiratory tract.
Sodium	Increases blood pressure. Vapors and fumes may cause eye, skin and respiratory tract irritation.
Styrene	Possible human carcinogen; known animal carcinogen. May cause eye, skin, and respiratory system irritation. CNS depressant.
2,4,5- TP (Silvex)	May cause contact dermatitis, fatigue, weakness, anorexia, dizziness, and abdominal pain.
2,4,5- Trichlorophenol	May cause eye, nose, pharynx, and lung irritation; skin redness and edema.
2,4,5-T (Trichlorophenoxyacetic Acid)	Weakness, malaise, loss of appetite, and heart failure.
2,3,7,8-Tetrachlorodibenzo-para-dioxin (2,3,7,8-TCDD, or Dioxin)	Known human and animal carcinogen. Chloracne; thymic atrophy; liver damage. Suspected to cause soft tissue sarcoma, Non-Hodgkin's Lymphoma, porphyria cutanea tarda, and Hodgkin's disease.
1,1,2,2-Tetrachloroethane	Possible human and animal carcinogen. Targets CNS, blood, liver, and kidneys. May cause drowsiness, nausea, vomiting, shallow breathing, liver enlargement, and possibly unconsciousness.
Tetrachloroethylene (PCE)	Probable human carcinogen and known animal carcinogen. Hepatotoxin; renal injury and CNS depressant. May cause dizziness, incoordination, and changes in mood, memory, reaction time, and vision.
Tetraethyl lead	May cause insomnia, psychosis, mania, liver damage, elevated blood lead levels, pallor, and disorientation.
Thallium	High levels may affect nervous system, lungs, heart, liver, and kidneys, and cause birth defects.
Thimet (Phorate)	Targets CNS, eyes, and skin.
Thorium	Known human and animal carcinogen. Series effects include lung, pancreas, & bone cancer.
Toluene	CNS depressant; liver and kidney damage. May cause confusion, tiredness, memory loss, loss of appetite, and hearing and color vision loss.
Toxaphene	Probable human carcinogen; known animal carcinogen. Targets the skin, liver, kidneys, and CNS.
1,1,1-Trichloroethane	Known animal carcinogen; CNS depressant, targets the liver and kidneys. May cause dizziness, loss of coordination, and decreased blood pressure.

1,1,,2-Trichloroethane	Possible human carcinogen. CNS depressant and skin irritant.
Trichloroethylene (TCE)	Known human and animal carcinogen. CNS depressant; renal and hepatic damage. Suspected increased risk of congenital heart defects in children of older women of child bearing age. May cause headaches, dizziness, sleepiness, coma, and autoimmune diseases.
Trifluralin (Treflan)	Possible human carcinogen. May cause respiratory tract, eye, and skin irritation.
Uranium	Known human and animal carcinogen. Series effects may include kidney damage, lung cancer, osteosarcoma, and lymphoma. May cause damage to dental tissue causing teeth to break, cataracts, necrosis of bone, and growth retardation in children.
Vanadium	May cause diarrhea and stomach cramps, and affect neurological and blood circulatory system.
Vinyl chloride	Known human and animal carcinogen; CNS depressant. May cause dizziness, unconsciousness, and nerve damage.
Xylenes	CNS depressant; liver and kidney damage. May cause headaches, loss of muscle coordination, confusion, and changes in one's balance.
Zinc	Some forms may be carcinogenic and/or affect the peripheral nervous system. All may cause gastrointestinal distress.
Zirconium	May cause eye irritation, blurred vision, burning of nose and throat, vomiting, and liver damage.

* A secondary associated risk is due to the decay product radon (radon-222 and radon-220), and its short-lived daughters. The primary hazard associated with radon arises from the inhalation of its short-lived decay products, which are charged ions that readily attach to dust particles. These particles can be inhaled into the lungs and deposited on the mucous lining of the respiratory tract, potentially leading to lung cancer;

APPENDIX B GLOSSARY OF HEALTH TERMS

GLOSSARY OF HEALTH TERMS

acnegenic

Producing or increasing the severity of acne.

aplastic anemia

A rare but extremely serious disorder that results from the unexplained failure of the bone marrow to produce blood cells.

carcinogenic or carcinogen

Capable of causing cancer. A suspected carcinogen is a substance that may cause cancer in humans or animals but for which the evidence is not conclusive.

central nervous system (CNS)

Brain and spinal cord.

chloracne

A rare acne-like skin condition caused by exposure to herbicides or chlorinated chemicals, including the dioxins. It develops a few months after swallowing, inhaling or touching the responsible agent.

cholinesterase

An enzyme produced in the liver that is required for normal nervous function.

conjunctiva

The membrane that lines the eyelids and covers the white part, or sclera, of the eyeball. When an individual has conjunctivitis, the reflection of the inflamed conjunctiva makes the white of the eye appear red.

cutaneous

Of, relating to, or affecting the skin.

embryotoxicity and fetotoxicity

Any toxic effect on the embryo (embryotoxicity) or fetus (fetotoxicity) as a result of prenatal exposure to a substance that crosses the placental barrier. The distinguishing feature between the two terms is the stage of development during which the insult occurs. Toxic effects can include malformations and variations, altered growth, and in utero death.

fetotoxicity

See "embryotoxicity."

genotoxicity

Damaging to DNA or pertaining to agents (radiation or chemical substances) known to damage DNA, thereby causing mutations or cancer.

gingival tissue

Gum tissue.

hepatic

Of, relating to, affecting, or associated with the liver.

Hodgkin's disease

One of the two basic types of lymphoma, Hodgkin's is a cancer that develops in the lymphatic system, the part of the body's circulatory system that helps fight disease and infection.

hyperpigmentation

An increase in the natural color of the skin.

hyporeflexia

Underactivity of bodily reflexes.

immunity

The ability of an organism to resist disease or toxins by natural or artificial means.

immunogenic

Producing immunity or evoking an immune response. An immunological effect is the production of a functional change in the immune response. Immunologic toxicity causes the occurrence of adverse effects on the immune system and may result from exposure to environmental agents such as chemicals.

keratosis

A disease of the skin marked by growth of scaly tissue.

lymphoma

Any of various malignant tumors that arise in the lymph nodes or in other lymphoid tissue.

mesothelioma

A malignant tumor of the mesothelium. The mesothelium is the thin lining on the surface of the body cavities and the organs that are contained within them.

morbidity

The rate of incidence of a disease.

mutagen

A substance that causes mutations. A mutation is a change in the DNA sequence contained in a cell. Mutations can lead to birth defects, miscarriages, or cancer.

mutagenic

Causing alteration in the DNA (genes or chromosomes) of an organism.

natality

The ratio of total live births to total population in a specified area over a specified period of time; birthrate.

narcosis

A condition of deep stupor or unconsciousness produced by a drug or other chemical substance.

non-Hodgkins lymphoma

A group of malignancies, with differing patterns of behavior and responses to treatment, in which cancer (malignant) cells are found in the lymph system.

osteosarcoma

A sarcoma derived from bone or containing bone tissue; also called osteogenic sarcoma.

peripheral neuritis

General classification of disorders involving damage or destruction of nerves, not including the nerves of the brain or spinal cord (CNS).

pneumonitis

A disease characterized by inflammation of the lungs.

porphyria cutanea tarda

The most common form of porphyria, causes blistering of skin exposed to sunlight. Porphyrins are a group of disorders caused by deficiencies of enzymes involved in the synthesis of heme, a chemical compound that carries oxygen and makes blood red.

pulmonary edema

A condition in which fluid accumulates in the lungs, usually because the heart's left ventricle does not pump adequately.

renal

Relating to, involving, affecting, or located in the region of the kidneys.

sarcoma

Cancerous growth of the soft tissues.

teratogenic

Capable of causing abnormal development of the embryo and congenital malformations.

teratogenicity

The ability or tendency to produce anomalies of formation.

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